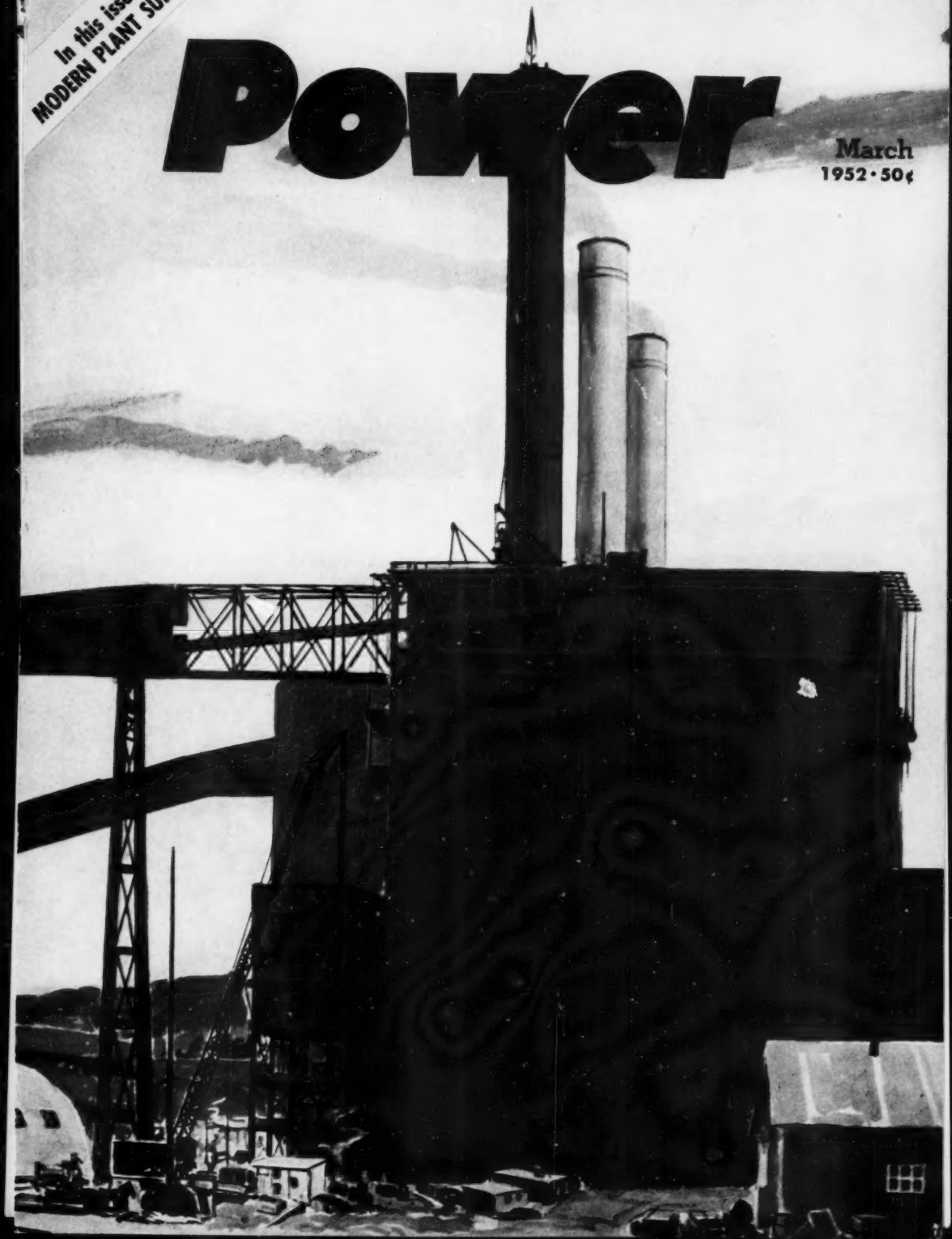
ENERATION,

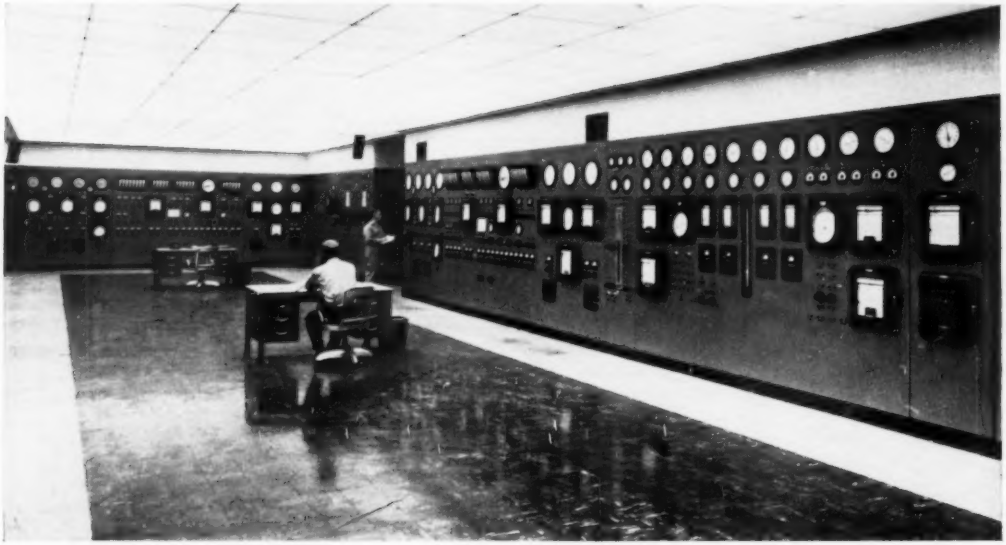
In this issue
MODERN PLANT SURVEY

TRANSMISSION AND APPLICATION OF THE POWER SERVICES ● A McGRAW-HILL PUBLICATION

Power

March
1952 • 50¢





Complete panels . . .

minimize engineering and installation time, reduce installed cost.

designed

Boiler, turbine and auxiliary control requirements are translated into a functional layout by our panel engineering staff. Upon your approval of the layout, we prepare final steelwork drawings, and electrical and piping diagrams. You thus receive drawings as a standard part of our panel engineering service.

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Panels are custom-engineered by specialists who have built panels for many of the country's major utilities during the past fourteen years. L&N panel engineering is a *complete* service of the Leeds & Northrup Company, 4910 Stenton Ave., Philadelphia 44, Pa.

LEEDS NORTHRUP

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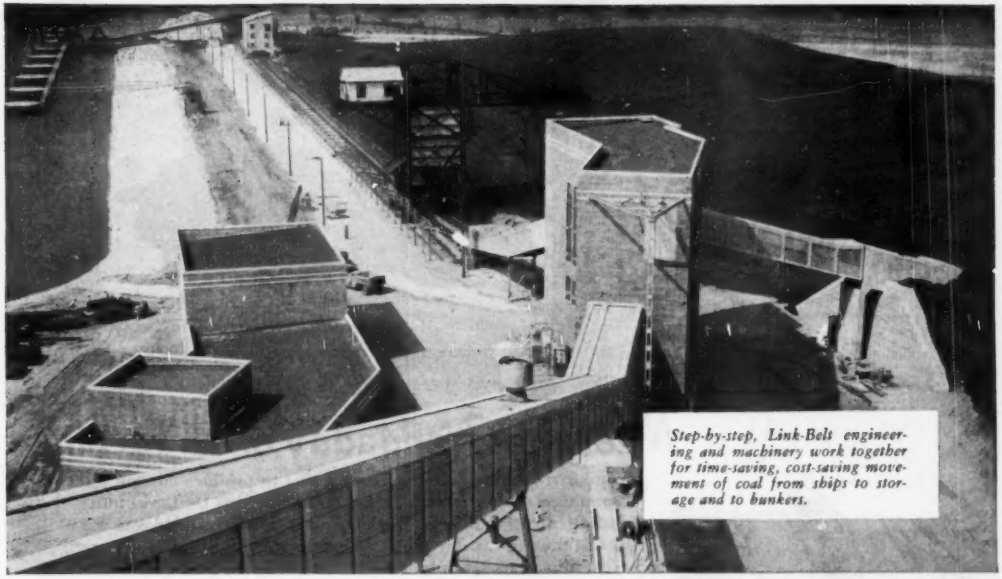
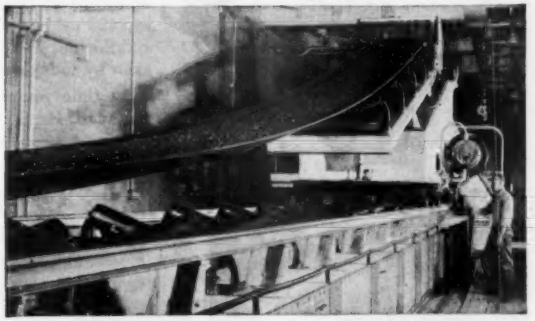
LINK-BELT engineering...



Step-by-step, Link-Belt engineering and machinery work together for time-saving, cost-saving movement of coal from ships to storage and to bunkers.

LINK-BELT equipment...

...combine to cut coal handling costs — from unloading to delivery to power plant bunkers



Link-Belt answers a vital need for the more efficient handling of coal in power plants—large and small. Here a Link-Belt Belt Conveyor and motor-operated traveling tripper distribute coal to bunkers through a dust-tight bin seal.

YOU name your coal handling problem—look to Link-Belt for the answer! Based on experience gained in hundreds of installations in power plants everywhere—Link-Belt has the facilities, the proven equipment, the engineering know-how to carry the ball from start of operations planning to delivery of coal. Regardless of the size of your plant—Link-Belt engineers can recommend exactly what you need for more efficient coal handling.

Conveyors, elevators, feeders, car dumpers and shakers, screens, hoists, hoppers, chutes, gates, stackers, unloading towers, weigh larries and related power plant equipment and accessories—all can be supplied by Link-Belt—*the most complete line* in the field.

So for simpler, more efficient, increased capacity coal handling methods—lower operating and maintenance costs—call on Link-Belt.

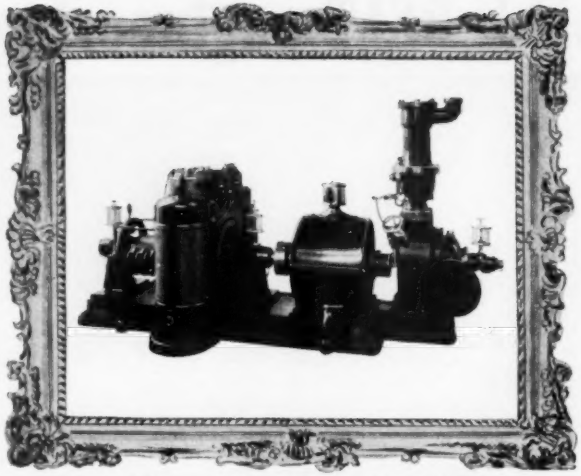
Our engineers will cooperate with you or your consultants to find the most economical solution for your problems. Write for details.

12.204

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

LINK-BELT
COAL HANDLING EQUIPMENT

De Laval Turbines at work!

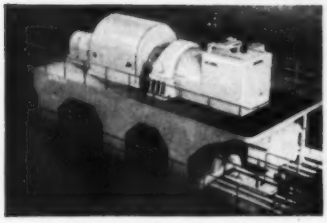


Meet the Grandaddy of all Turbines

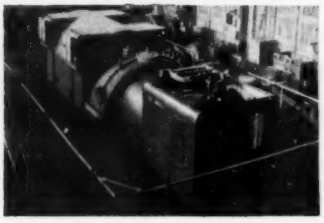
The first turbine-driven generating set to produce current on a commercial scale in the United States was this De Laval unit installed at the Chicago World's Fair in 1893. Grandad was a fast man in his day too . . . he delivered 10 hp at 24,000 rpm. Just four years later, four De Laval 100 hp turbine generators operating at 2840 psi, 750° F and two 50 hp turbines operating at 1420 psi supplied all the power for the Stockholm Exhibition. That is high pressure, high temperature operation even by today's standards!

Next time you're in our neighborhood stop in and see Grandad. He is on display in our reception room. Then let us take you through our shops . . . there you'll see how the finest turbines in the country are built.

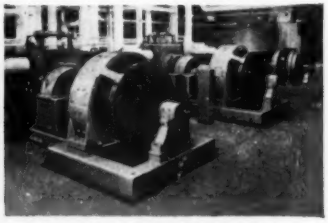
and here are a few of his Grandsons—



7500 KW De Laval turbine generator installed in the municipal power plant of the city of Lubbock, Texas. The 15 stage turbine is designed for 600 psi, 825° FTT.



This 11,500 KW De Laval turbine generator and another just like it will soon be supplying power for one of our key Naval bases.



Power for a New England textile mill is generated by these three 1000 KW De Laval geared turbine generators.

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

DE LAVAL

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
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DL 122

Power

MARCH 1952 VOLUME 96 NO. 3

combined with Operating ENGINEER

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own index annually, copies of which are available on request to the editorial offices.

POWER PLANTS can inspire artists just as they do those of us who build and operate them. For proof you've only to look at Pennsylvania Power & Light Co's collection of fine paintings—"Portrait of Power."

This was born back on Sept 24, 1950, when 72 members of the Lehigh Art Alliance journeyed 100 miles to PP&L's new Sunbury plant to record on canvas the color and dynamics of power production. Out of this trip came 99 fine paintings, later exhibited in PP&L's general-office display rooms and viewed by more than 4000.

Two nationally known authorities selected the 25 outstanding paintings acquired by PP&L. These form a permanent collection, which has been widely shown.

From "Portrait of Power" we chose "Construction—New Power Unit at Sunbury," by Karl Manahan, as typifying the vast power building job reported in our 1952 Modern Plant Survey (p 79), and enjoyed PP&L's cooperation in producing from it an outstanding POWER cover.

Next month . . .

■ Most of us have a healthy respect for what it takes to make high-pressure high-temperature piping. Even so, your respect will grow when you trace, via an April picture story, the long trail from alloy-steel ingot to an operating main-steam line.

■ Worried about rising steam costs? Good operation and maintenance go a long way toward keeping them in line. See how in next month's PO&M section.

■ Many small-plant engineers miss out on the benefits of mechanical coal and ash handling because they think it costs too much. A new survey gives dollars-and-cents facts for intelligent decisions.

■ A motor is no better than its commutator—that's why you'll want to read April's practical guide to tip-top commutator maintenance.

. . . and future months

■ High-pressure hot water—superheated water—has many advantages as an industrial heating medium. Beginning in May, a new series tells you what these advantages are, gives all the dope you need to decide if it's the answer to your process problems.

TURBINE OIL STILL GOOD AS NEW AFTER 34,498 HOURS OPERATION...

TEXACO REGAL OIL (R&O) keeps Kentucky Utilities Company turbines "on the line"

"We have used *Texaco Regal Oil (R&O)* with perfect results and not a single difficulty," says Mr. Bryan Bunch of Kentucky Utilities Company, Tyrone, Ky. "The oil has never been changed since turbines were installed and recent tests show it to be as good as new."

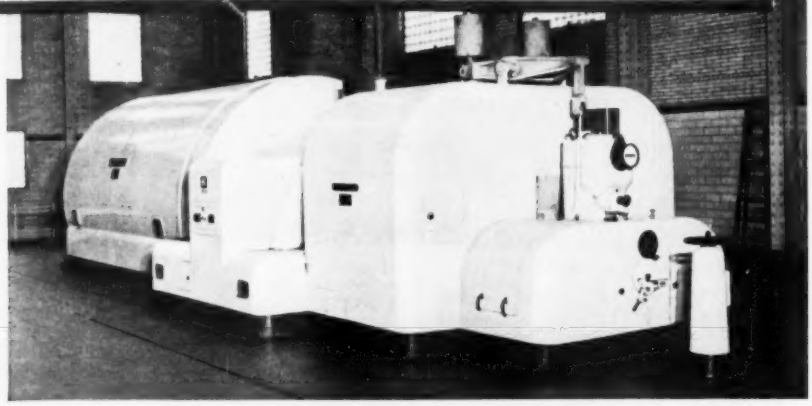
Kentucky Utilities has two 25,000 KW turbines. No. 1 has been operated for 34,498 hours, No. 2 for 28,547 hours. Both run most of the time at full load, occasionally are overloaded.

Ability of *Texaco Regal Oil (R&O)* to stand up under severe load conditions and keep turbines free of rust, sludge and foam, springs from the fine quality of the base stocks used. These are carefully refined, fortified with special Texaco additives and specially processed to make them *more than ten times as oxidation-resistant* as ordinary turbine-quality oils and vastly more resistant to rust and foaming.

There is a complete line of *Texaco Regal Oils (R&O)*, all designed to give your turbines extra protection throughout an extra long service life. They more than meet the stringent requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer show you in detail the cost-saving advantages of Texaco lubrication. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Regal Oils (R&O)

FOR ALL TURBINES

Faithfully yours 50 *for Fifty Years*

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...with Power readers...

COAL-PILE FIRES

I read with interest . . . "How You Can Store Coal in Safety" (POWER, Jan 1952, p 82) . . . it was very good advice but I do think you left us high and dry when you came to suggestions for putting out fires. . . .

I have had experience with coal fires in piles and in bunkers and have found that the most satisfactory way to bring the fire under control is with CO_2. In pile fires, a pipe fitted with a water driller's point driven into the pile . . . and CO_2 gas left to bleed into the area is the most effective scheme. . . . If a driller's point is not available, crush the end of a pipe and drill a few holes. The CO_2 being heavier than air, will remain in the coal a long time and will filter through it to extinguish the fire.

In steel bunkers, I have fitted the sides with pipe fittings and deflector plates on the inside to keep the holes from plugging. Holes can be capped when not in use.

Cincinnati, Ohio — W C HELT

EVER WONDER . . .

. . . how the lettering on POWER's *drawings is done? Engineers in a well-known consulting firm did recently, asked us to settle an intra-office debate as to whether it is done by hand or by mechanical lettering guides. Because good drawings and legible*

(*Continued on page* 214)

...lines and bylines

NEW THINKING in an old field may put Neil Bailey among long-time "greats" of heat-power history. For a look at this new thinking, and what it may mean, turn to p 74.

Neil P Bailey

In a way, Neil has been preparing for such a discovery throughout a long career of teaching and research. A Coloradan by birth, his education there was interrupted by a World War I tour with the Marine Corps in Asia. Back home, he took his BS in ME at University of Colorado (1924).

Then, at GE, Neil helped develop domestic refrigerators. Teaching began at University of Idaho in 1925; while there he received his MS. At University of North Carolina, where he went in 1929, he built up graduate work and research. Similar problems of revitalizing and reorganizing faced him in his next two assignments: as head of department at Iowa State and Rutgers.

In 1942, research in new fields of gas turbines and jet propulsion called him back to General Electric. Since 1945, Neil has been Russell Sage professor of mechanical engineering and head of the ME department at Rensselaer Polytechnic. Unanswered questions of current research there led to development of his new theory.

"NO MORE SURVEYS!" That's what POWER staffers usually say when the last of the Modern Plant Survey tabulations (pp 82-102) are checked and OK'd for the printer. Yet within a week, the continuous process of collecting information on new installations, sending out questionnaires and analyzing returns is under way again.

Joseph C McCabe

It's a team job (see tables for individual credits), but on the shoulders of Associate Editor Joe McCabe falls the responsibility of coordinating the work of the rest of the gang.

Joe tackles it with a grin and carries through without once losing his characteristic good nature. It was really put to the test during the final stages of this year's survey, though. Joe's New Jersey home was badly damaged by fire. So he's been working on POWER chores by day, spending evenings and weekends supervising reconstruction and wrestling with insurance claims. Look's like he's winning.

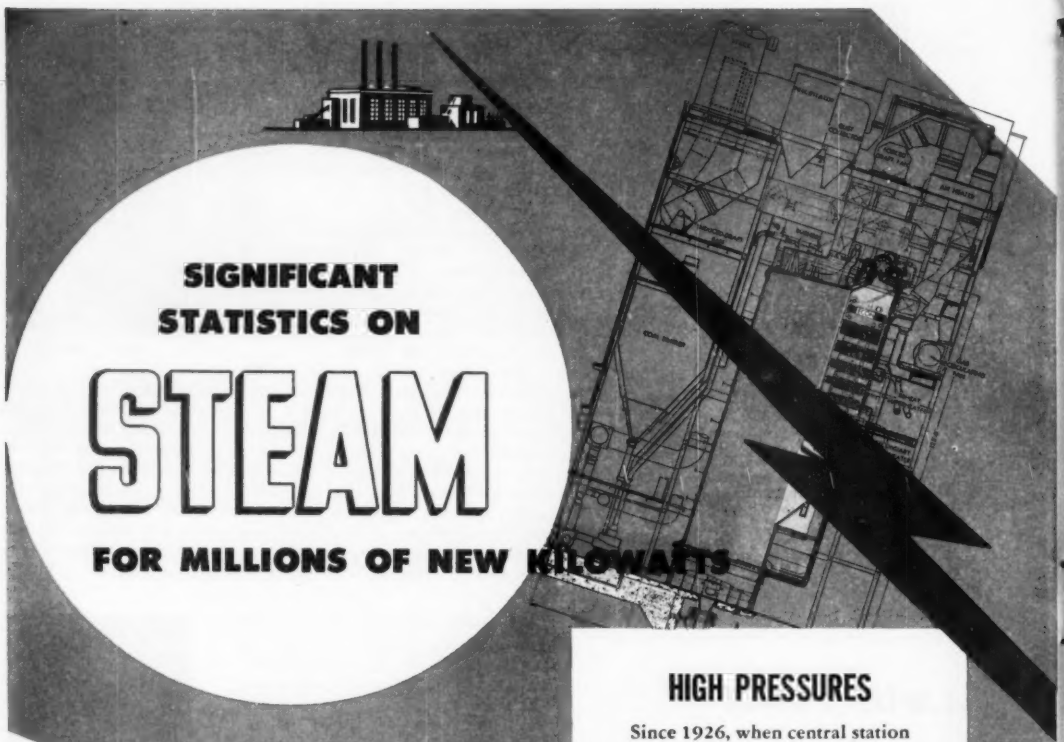
GEORGE EDWARDS, old friend and regular contributor, dropped in the other day. He had a gleam in his eye and a bundle of photos under his arm. We don't know what we were expecting—perhaps some shots of his new plant layout—but we sure didn't expect the fathead character at the right.

Me, a fathead?

"Reminds me of a chief I worked for," said George, and told us why. (If you want to know, see p 166.)

"Say," we yapped, in the grasp of a bright idea, "that picture and the yarn would make a good editorial."

George grinned. "You haven't seen anything yet—look!" And out of the folder he yanked about ten more animal characters, and "sermon texts" to go with them. So now all we can say is "*You* haven't seen anything yet—watch for the rest of the hippo parade."



SIGNIFICANT STATISTICS ON STEAM

FOR MILLIONS OF NEW KILOWATTS

CYCLONE FURNACES

At the close of 1951, B&W's revolutionary method of coal-firing had been applied to boilers with steam capacities ranging from 65,000 to 1,200,000 lb. per hr.; design pressures to 2125 psi; and steam temperatures to 1050F. Reheat, pressurized furnaces, and gas recirculation were other features in many of these units. Fuels include Illinois and West Virginia coals, lignite, oil and gas. Total steam capacity of all Cyclone Furnace boilers in service and on order is over **19,000,000 lb. per hr.**

HIGH PRESSURES

Since 1926, when central station boiler design pressures entered the now widely specified range over 1400 psi, B&W has been "headquarters" for high-pressure units. At the end of 1951, nearly 300 B&W natural-circulation units designed for pressures between 1400 and 2700 psi with temperatures up to 1100F, and including the world's largest boilers, were in service or on order. In the field *over* 2000 psi, more than 50 B&W units have been ordered since 1937, and 12 of them are in full-scale operation with outstanding performance records.

Power companies have taken advantage of this unique experience in the range over 1400 psi for an aggregate high-pressure steam-generating capacity of **187,000,000 lb. per hr.**

PRESSURE FIRING

Steadily-growing demand for this advanced principle of boiler furnace operation reflects the confidence of power companies in its demonstrated advantages of higher boiler efficiency, lower auxiliary power, and other significant economies. More than a score of power companies now have in service or on order over 75 B & W Pressure-fired units with a total steam capacity of **51,910,000 lb. per hr.**

GAS RECIRCULATION

Applications of the B & W methods of gas recirculation for superheat and reheat temperature control almost doubled during 1951. Over 75 units employing this feature are in service or on order, with capacities ranging up to 1,370,000 lb. per hr., and with all types of firing. Total steam capacity of all units having gas recirculation is nearly **75,000,000 lb. per hr.**

REHEAT

New B & W reheat boilers ordered during 1951 raised the total steam-generating capacity of B&W reheat units in service, under construction, and on order to over **95,000,000 lb. per hr.**

NEW UNITS IN SERVICE

During 1951, power companies placed orders for B & W boilers aggregating over 60,000,000 lb. per hr. of steam-generating capacity. In the same period, B & W central station units totalling 28,000,000 lb. per hr. were placed in service. The unique experience and advanced steam technology reflected in these and other statistics presented on these pages are good reasons why you will want to draw on B & W's vast wealth of research and engineering know-how whenever you are considering additional power generating facilities. Its broad and diversified base assures you the most considerate and unbiased approach to your specific requirements—an approach essential to the most efficient and economical solution of any modern power problem.

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET
NEW YORK 6, N. Y.

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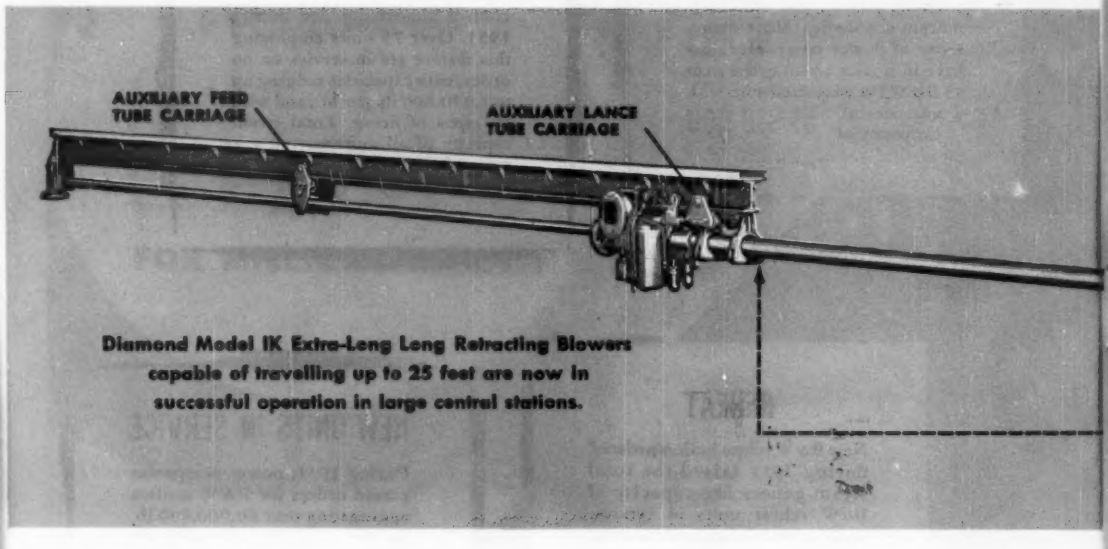
EXTRA LONG

Long Retracting Blowers . . .



Diamond Model IK Extra-Long Long Retracting Blowers capable of travelling up to 25 feet are now in successful operation in large central stations.

For correct tube cleaning in extremely wide furnaces, Diamond has developed the Model IK Blower with auxiliary lance and feed tube supports and with increased power (either electric or air motor). There is a moving carriage that provides intermediate support for the feed tube while the blower is operating, and a second moving carriage that provides intermediate support for the lance tube in the retracted position. Positioning of these two auxiliary carriages is automatically synchronized with movement of blower.

This Diamond development now makes it possible to correctly clean tube banks in furnaces of greater widths than was previously possible with any retracting soot blowers on the market. There are other Diamond developments now undergoing tests that will also contribute to the advancement of boiler cleaning practices . . . particularly for very wide high-capacity units.

DIAMOND POWER SPECIALTY CORPORATION

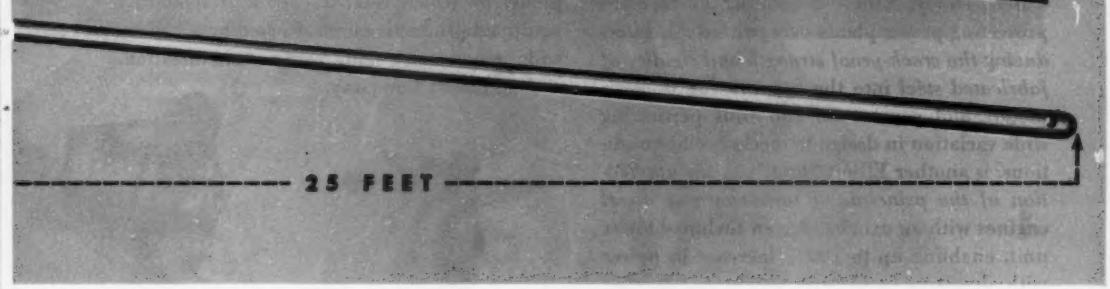
LANCASTER, OHIO

Diamond Specialty Limited • Windsor, Ontario

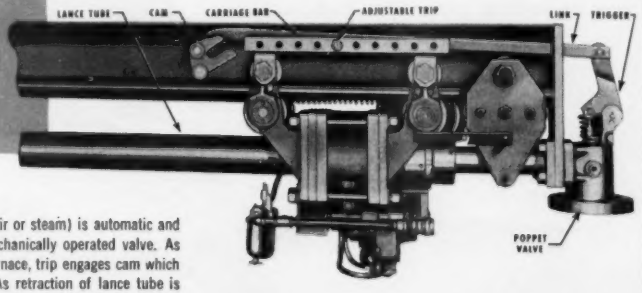
The CORRECT BLOWER for Every Boiler Cleaning Need

Another DIAMOND DEVELOPMENT

for the Better Cleaning of Large, Modern Steam Generators



Mechanically Operated Valve



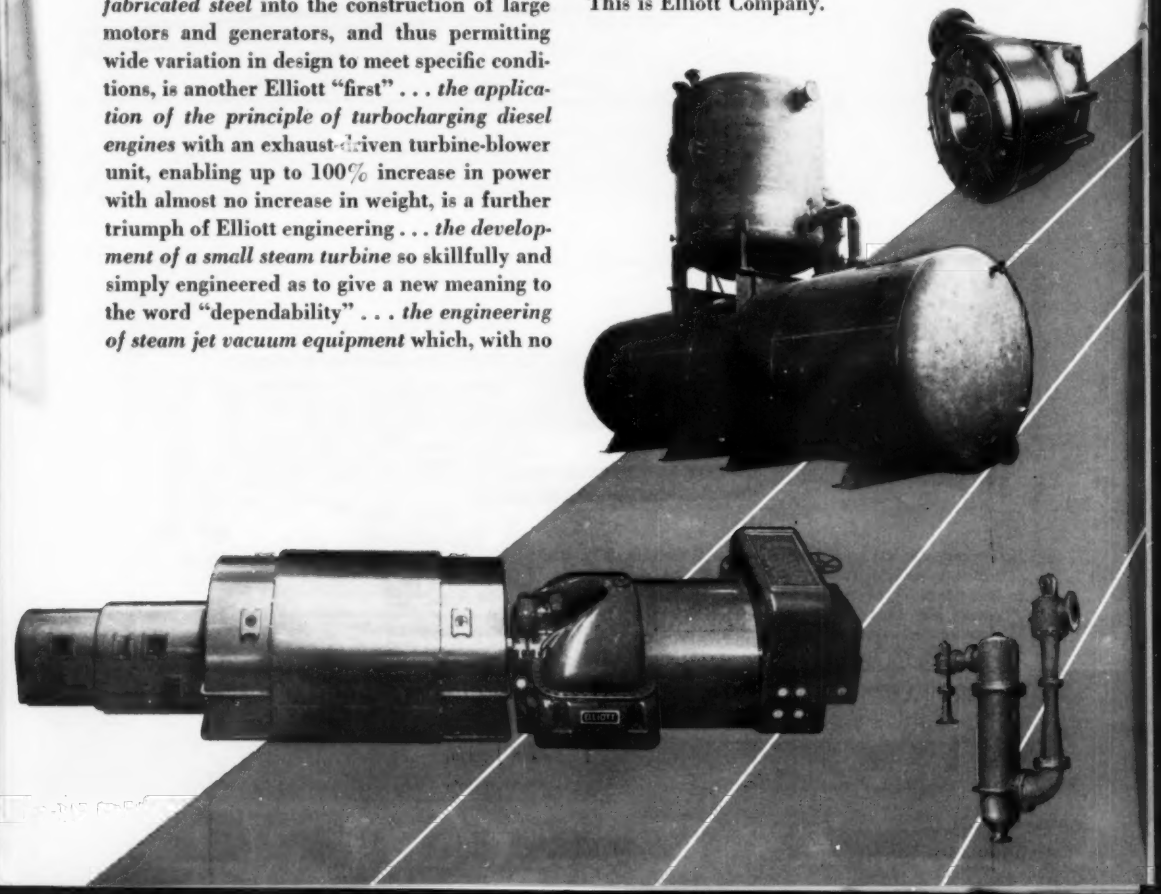
Control of the blowing medium (air or steam) is automatic and accurate by means of a simple mechanically operated valve. As lance tube begins movement into furnace, trip engages cam which actuates valve through a linkage. As retraction of lance tube is completed, trip reverses movement of cam, closing the valve.

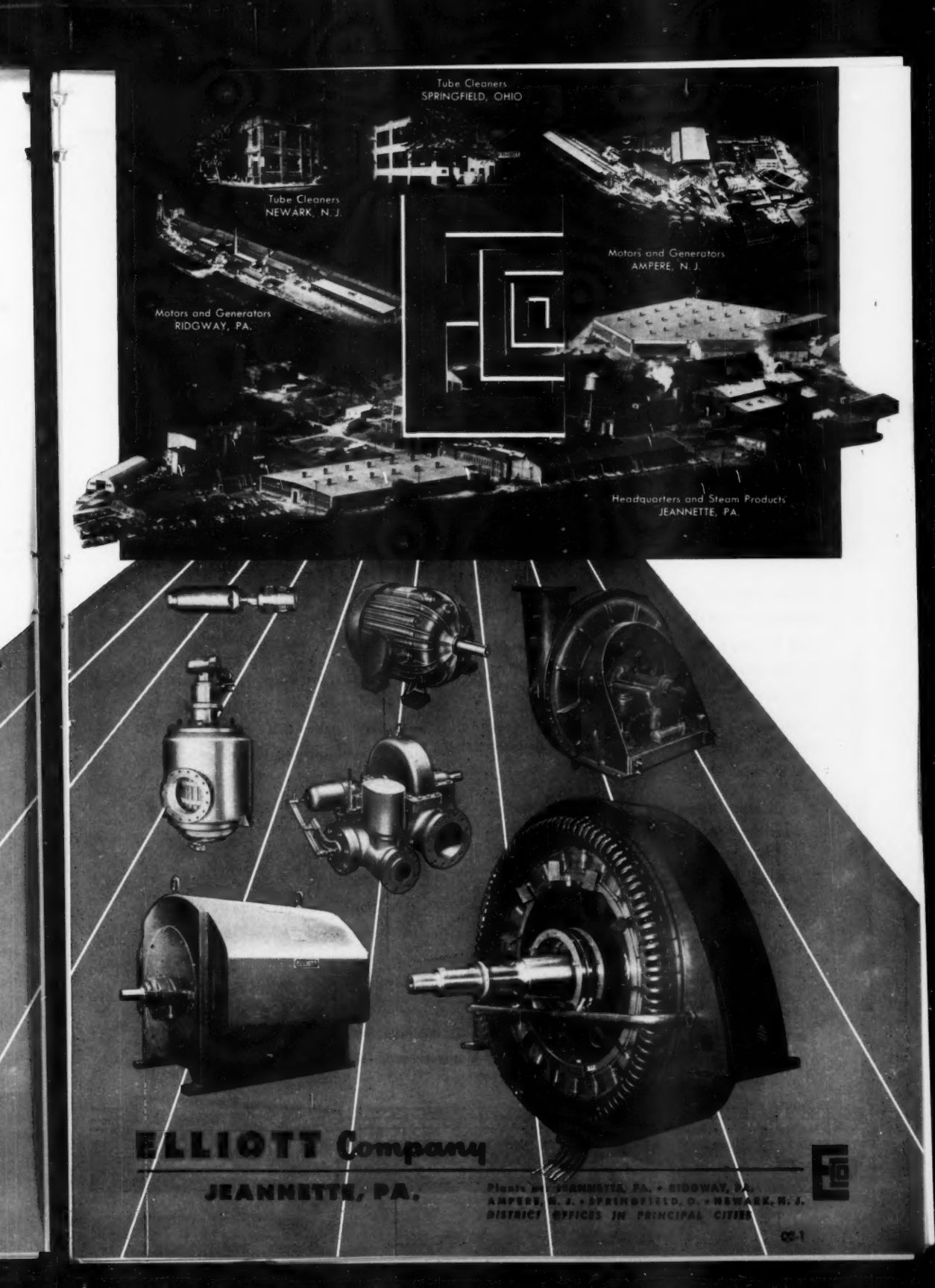
Important advantages: (1) positive valve action (2) adjustable valve operating position (3) low pressure drop (4) completely adaptable to steam and air blowing interchangeably (5) no critical adjustment for tight valve seating (6) adjustable pressure control on each individual blower.

This is ELLIOTT COMPANY

Sparkplug of progress in power generation and the process industries!

WINNING THE WAR WITH CORROSION in steam power systems, was the direct result of Elliott engineers' work in *deaeration*—the removal of rust-causing oxygen from boiler feedwater. Today, Elliott deaerating heaters are protecting power plants everywhere . . . *introducing the crack-proof strength and rigidity of fabricated steel* into the construction of large motors and generators, and thus permitting wide variation in design to meet specific conditions, is another Elliott "first" . . . *the application of the principle of turbocharging diesel engines* with an exhaust-driven turbine-blower unit, enabling up to 100% increase in power with almost no increase in weight, is a further triumph of Elliott engineering . . . *the development of a small steam turbine* so skillfully and simply engineered as to give a new meaning to the word "dependability" . . . *the engineering of steam jet vacuum equipment* which, with no moving parts, produces a new low in commercial absolute pressures . . . all these and more are the contribution of a single organization to America's industrial progress, the combined plants of which total 27 acres of modernly equipped productive area, backed by a nation-wide engineering and service organization. This is Elliott Company.

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How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

●

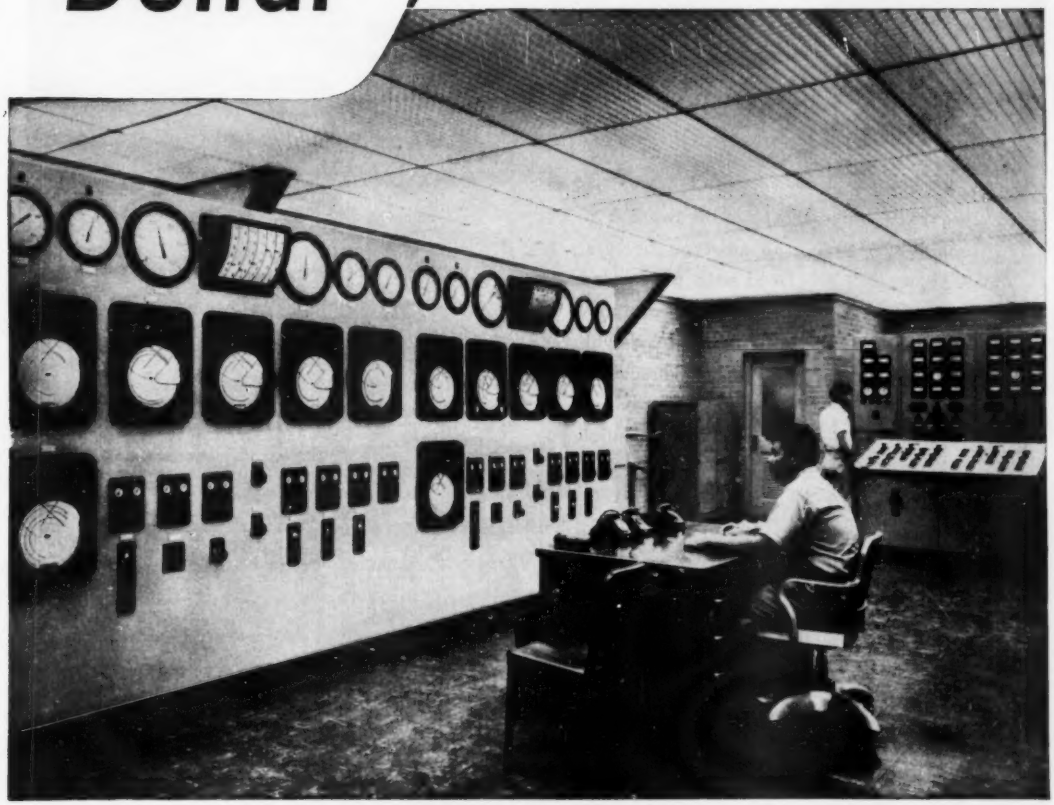
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

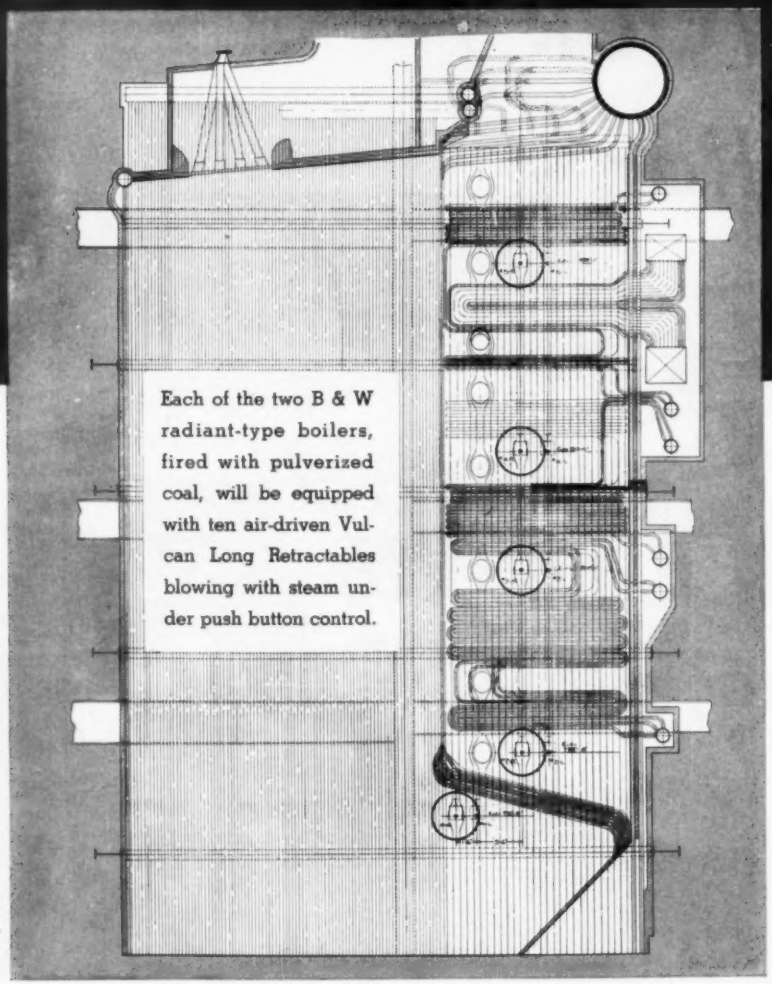
INCREASE of YOUR Dollar



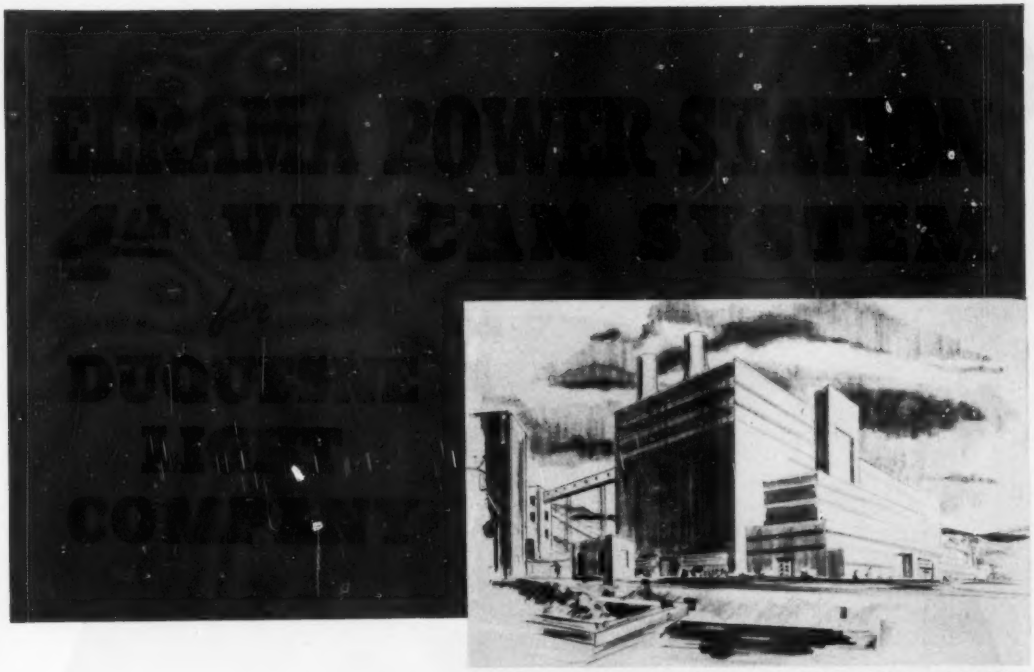
These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 50,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA



Each of the two B & W radiant-type boilers, fired with pulverized coal, will be equipped with ten air-driven Vulcan Long Retractables blowing with steam under push button control.



ELRAMA POWER STATION, DUQUESNE LIGHT COMPANY

FOR the fourth time in its $112,000,000 post-war expansion and construction program, Duquesne Light Company has ordered Vulcan Automatic Soot Blowers. This latest order is for the new Elrama Power Station near Clairton, Pennsylvania, which will add 190,000 kilowatts to the system generating capacity. Each of the two Babcock & Wilcox radiant-type boilers will have a capacity of 900,000 pounds of steam per hour at 1350 psi and 950 degrees F. Each will have ten air-driven Vulcan Long Retractables, blowing with steam under push button control. The swing to Vulcans continues, as alert engineers learn that Vulcan cleans better and costs less to maintain.

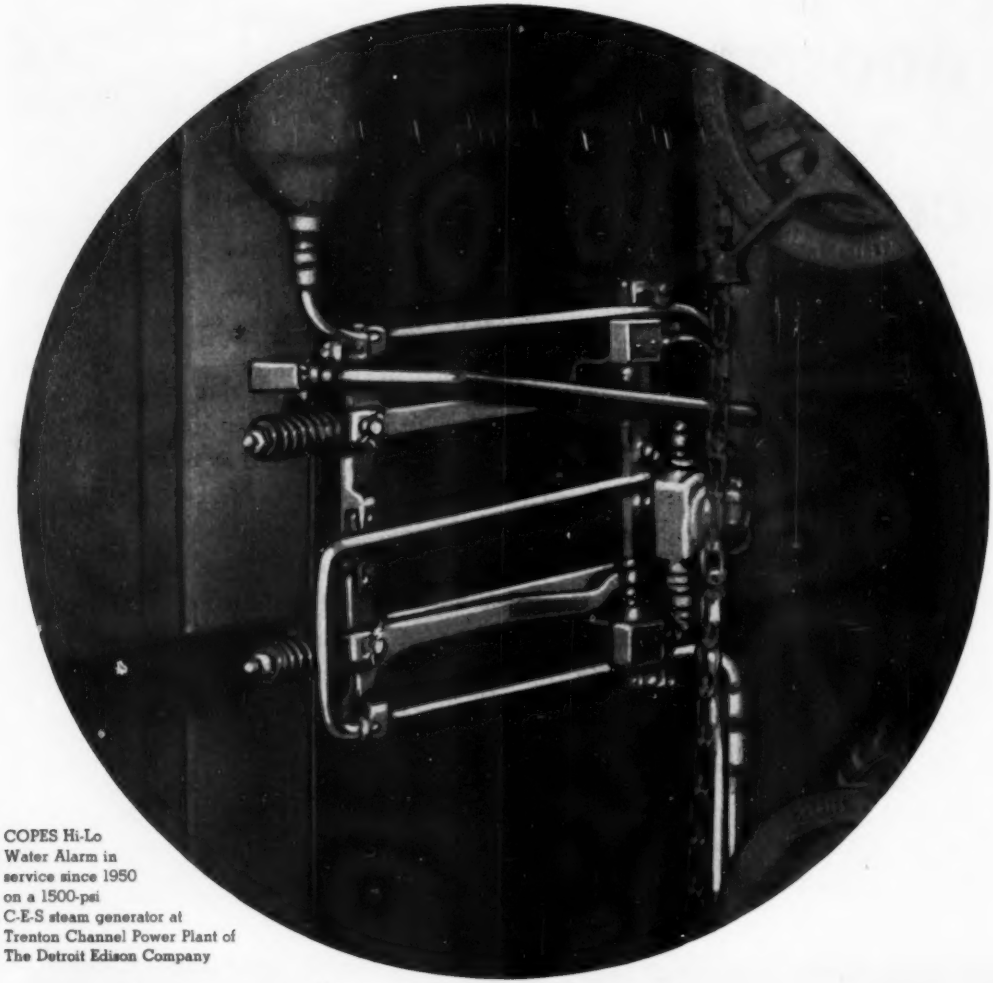
VULCAN SOOT BLOWER DIVISION

Continental Foundry & Machine Company

DUBOIS, PENNSYLVANIA

COPES Hi-Lo

as simple and dependable



COPES Hi-Lo
Water Alarm in
service since 1950
on a 1500-psi
C-E-S steam generator at
Trenton Channel Power Plant of
The Detroit Edison Company

ENGINEERED BY THE MAKERS OF

WATER ALARM

as the COPES expansion tube

HERE'S a new Hi-Lo Water Alarm, based on exactly the same established principle that has made the COPES Feed Water Regulator so successful for the last fifty years.

On both stationary and marine boilers, it gives trouble-free dependability at all working steam pressures.

Simple, fool-proof and maintenance-free. Compact and self-contained. Easily installed without special supports or complicated piping—with or without a water column.

Bulletin 493 tells the full story. Write for it.

NORTHERN EQUIPMENT DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
321 Grove Drive • Erie, Pennsylvania

The COPES Hi-Lo Alarm uses no bellows, no diaphragms, no weights, no floats, no differential pressure devices. It has no internal parts to corrode or wear. Standard audible signal is a horn; standard visible signal, lights. Other types of signal can be furnished as desired.

COPES

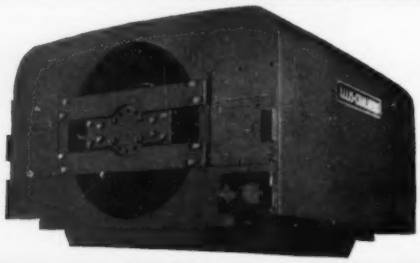
FEED WATER REGULATORS

WA-Series

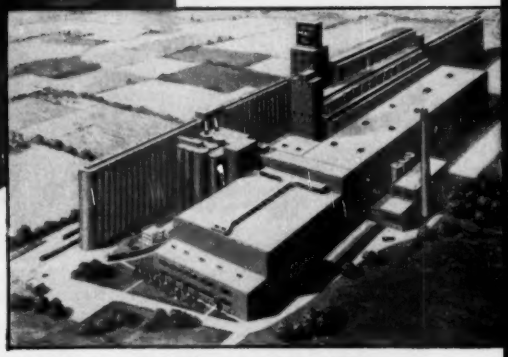
STEAM TURBINE GENERATOR UNIT

Doing Double

AT ONE OF WORLD'S LARGEST MALT



SIMPLIFYING INSTALLATION, both turbine and generator (shown at left) are shipped as complete assemblies with the rotors locked in place. The WA-Series generator is of the housing type with air-coolers mounted in the stator above the floor lines, eliminating special coolers and duct work.



Ladish Malting Co. Uses Steam for both Processing and Power Generation

Duty

HOUSES!

GREAT QUANTITIES OF STEAM are required in the process of manufacturing 10 million bushels of malt annually at the Ladish Malting Co., Jefferson Junction, Wisconsin. And, as an economic by-product, the electric power needed for plant operation is generated by the same steam.

When this world's largest single unit malt house recently needed more generating capacity, Allis-Chalmers again was chosen. And with good reason, since two Allis-Chalmers units had been supplying the electric power consumed at the Ladish Malting Company for nearly fifteen years.

Installed in 1951, the modern 2500 kw WA-Series unit shown here is now on 24 hr a day, 7 day a week duty. It consists of a non-condensing impulse steam turbine and housing type air-cooled generator and exciter . . . carefully engineered and manufactured to operate as an integrated unit.

Built for condensing or non-condensing service in NEMA ratings through 7500 kw, a modern WA-Series unit also will enable *your* power plant to meet tomorrow's expanded power demand. Complete details contained in new Bulletin 03B7654. For your copy, just call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

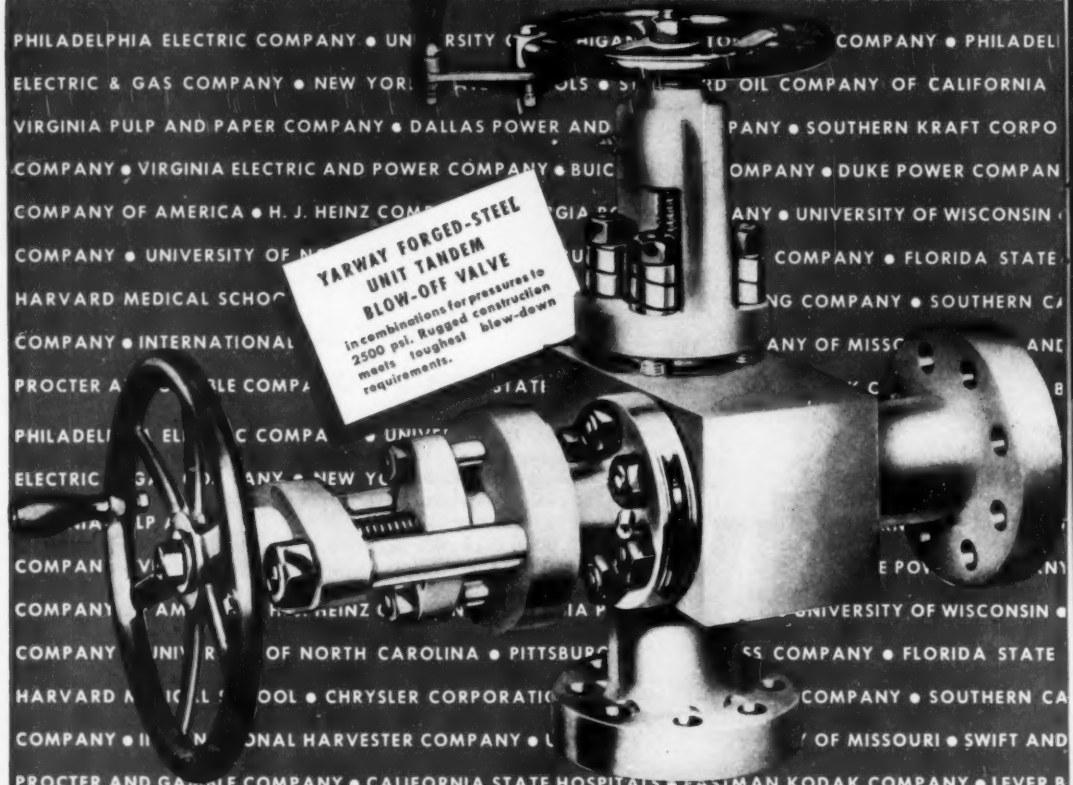
A-3601

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A BLOW-

IS HOUND TO THE


YARWAY FORGED-STEEL
UNIT TANDEM
BLOW-OFF VALVE
In combinations for pressures to 2500 psi. Rugged construction meets toughest blow-down requirements.

YARWAY

HIA PUBLIC SCHOOLS • PACIFIC GAS & ELECTRIC COMPANY • IOWA STATE COLLEGE • PUBLIC SERVICE

OFF VALVE

R. J. REYNOLDS TOBACCO COMPANY • CARNEGIE INSTITUTE OF TECHNOLOGY • HUMBLE OIL AND REFINING

BOILER IT PROTECTS

COMPANY • FLORIDA POWER COMPANY • ARMOUR AND COMPANY • UNIVERSITY OF PENNSYLVANIA •

When buying blow-off valves, weigh the significance of these two facts:

More than 15,000 boiler plants in the United States and other countries are equipped with Yarway Blow-Off Valves... Some of them for nearly 40 years. *Among high pressure plants, 4 out of every 5 in the United States are Yarway-equipped.*

Design, metallurgy, workmanship and service are the reasons. It was Yarway that brought out the famous Seatless Valve, teamed it with a stellited hard-seat valve in a common forged-steel body to make the popular Unit Tandem. Yarway has also made available metallurgical improvements to withstand the chemical reactions of acid wash as well as the mechanical wear of boiler blow-down.

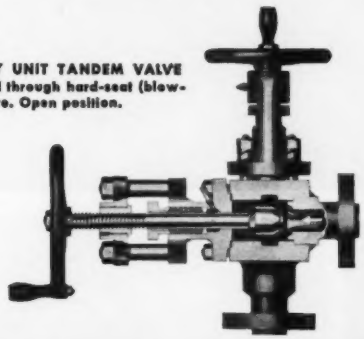
Yarway continues to pioneer and improve blow-off valves and blow-off valve service for both high and low pressure applications.

On new boilers, replacements or modernization, make sure you specify Yarway Blow-Off Valves. Any boiler manufacturer will supply them on your specification.

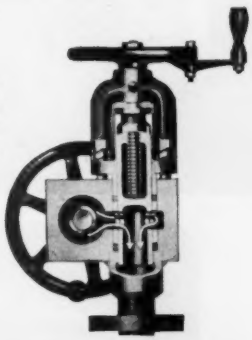
Bulletin B-424 gives you the full story on pressures to 400 psi. Bulletin B-433 for higher pressures. Both are free. Write...

YARNALL-WARING COMPANY, 100 Mermaid Ave., Philadelphia 18, Pa.

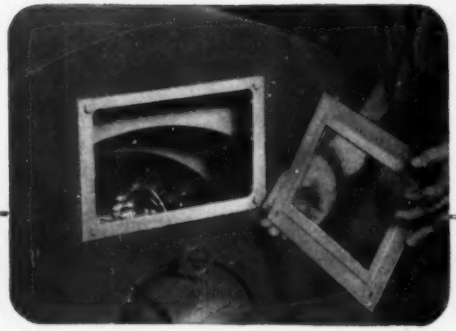
YARWAY UNIT TANDEM VALVE sectioned through hard-seat (blowing) valve. Open position.



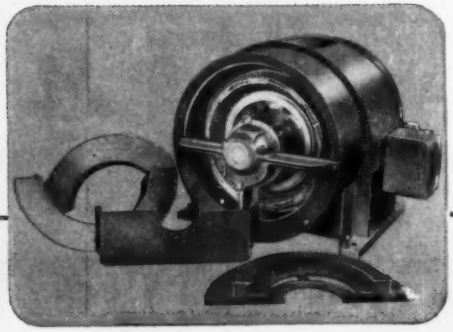
YARWAY UNIT TANDEM VALVE sectioned through seatless (sealing) valve. Open position.



Below is a typical forced-ventilated installation. Motor can be arranged so ducts can be brought in at any angle.



Lucite window makes brush inspection easy. Simply remove window for quick entrance to brushes . . . for checking and inspection and maintenance.



Light, sturdy end covers and air shields are easily and quickly removed for inspection and cleaning. No crane is required. One man can do the job easily.

MORE POWER PER DOLLAR

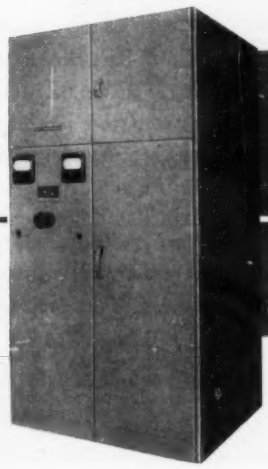
Synchronous Motor Offers New Installation Flexibility

When forced ventilation is required you can eliminate many installation problems with this synchronous motor. Air is supplied to the motor from both ends through air inlet brackets . . . two at each end, on either side. Duct or pipe connections can be brought from above . . . from below . . . from one side or the other . . . or a combination. Thus, you can position the motor without regard for duct work.

Covers and air shields, too, add to installation flexibility. They can be easily removed — by hand — for inspection or cleaning of the motor. No crane is required. Thus motors can be mounted in hard-to-reach places.

This added installation flexibility may open up new opportunities to save money with synchronous motors. In many cases, these motors will improve your power factor and reduce your power bill. They provide more power per dollar for many types of drives than any other motor.

Get all the facts on Westinghouse Synchronous Motor savings. Ask your Westinghouse representative for information on the simplified inspection and servicing these motors offer. Complete information is available. Ask him for a copy of DB-3200 or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10354

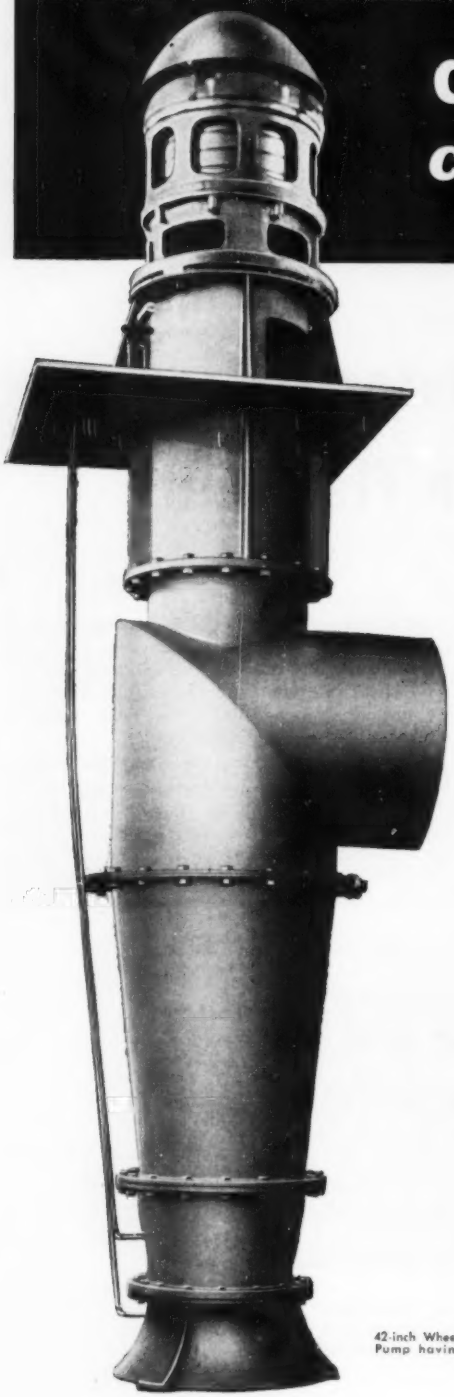


Westinghouse

SYNCHRONOUS MOTORS AND CONTROLS

Matched control for the motor. This Slipsyn Synchronous Motor Control protects your motor investment . . . helps you get more for your power dollar.

C. H. WHEELER & *CONSOLIDATE TO*



42-inch Wheeler-Economy Vertical Axial Flow Pump having capacity of 40,000 G.P.M.

Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company have consolidated engineering and manufacturing facilities in C. H. Wheeler's plant at Philadelphia. Facilities are now being expanded through new construction and the installation of additional modern machine tool equipment.

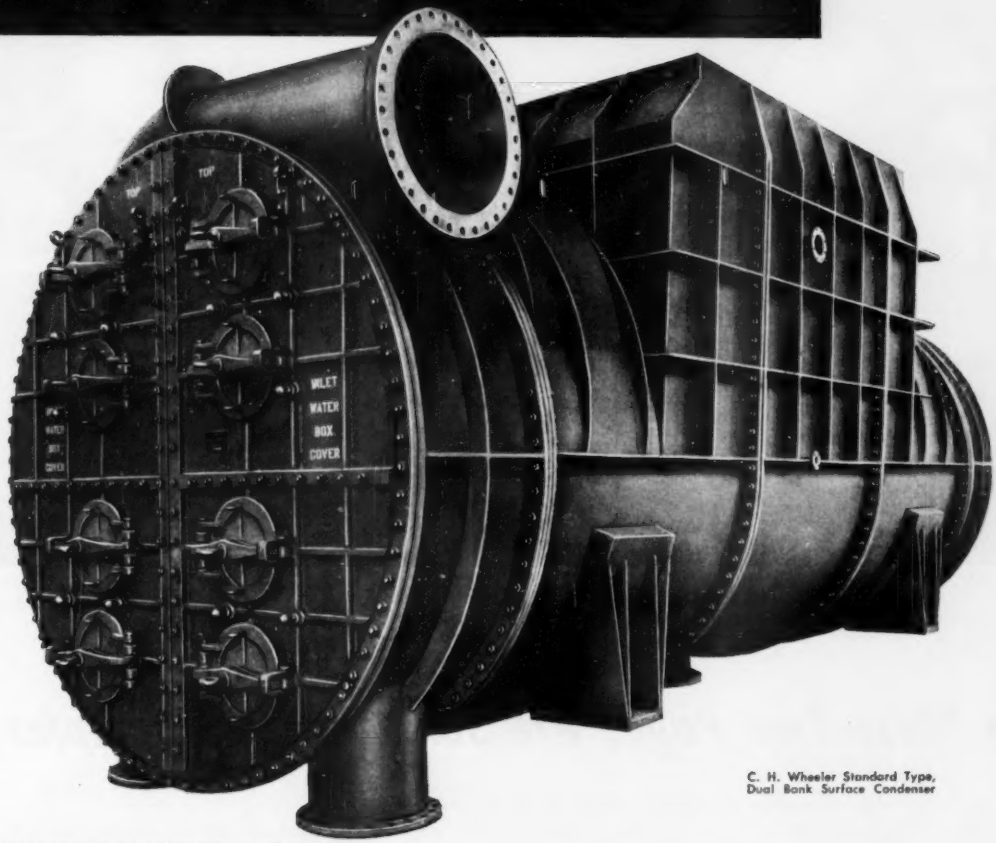
PUMPS . . . Economy has for many years been among the leaders in the engineering and manufacture of centrifugal, axial and mixed flow pumps. Today, the Wheeler-Economy line is one of the most modern and complete in the pumping industry.

CONDENSERS & POWER PLANT EQUIPMENT . . . The C. H. Wheeler Manufacturing Company has contributed many of the outstanding developments in the field of condensing apparatus and vacuum problems. Nearly a decade ago, C. H. Wheeler adopted Economy mixed flow pumps for use with their condensers.

PROCESS EQUIPMENT . . . C. H. Wheeler is also internationally known for Cooling Towers, Steam Jet vacuum apparatus and Fine Particle Reduction Mills, vital links in modern chemical and food processes. Wheeler-Economy Pumps will round out the company's services in these fields.

MARINE GEAR . . . C. H. Wheeler's Marine Gear, Condenser and Deck Machinery department will be augmented by Wheeler-Economy Pumps designed for marine application.

ECONOMY PUMPS, Inc.
SERVE YOU BETTER . . .



C. H. Wheeler Standard Type, Dual Bank Surface Condenser

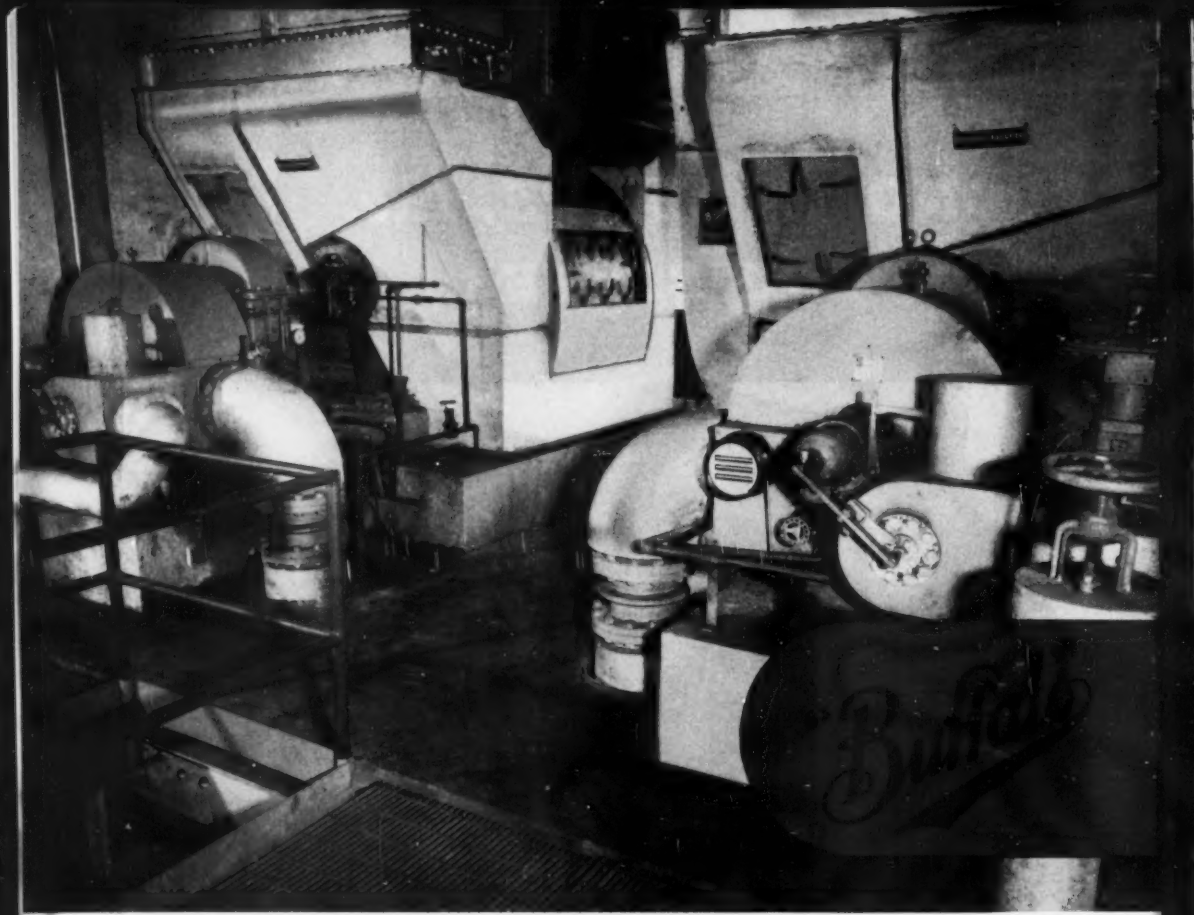
WHEELER-ECONOMY PUMPS

. . . a new name combining old names that have been known and respected for generations. All the experience and metal working techniques this consolidation brings together are of great importance to you — our customer. Wheeler-Economy Pumps will fill your every requirement regardless of size or problem involved. Write to Philadelphia or to the nearest Economy or Wheeler representative listed in the phone directories of principal cities.

113

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.



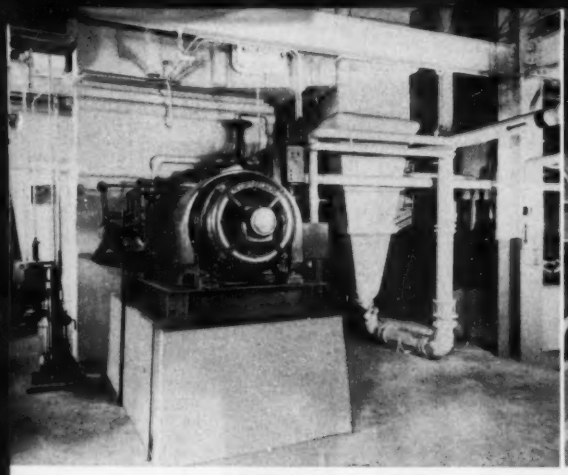
Above are two "Buffalo" Induced Draft Fans at the Bridgeville plant of American Cyanamid Company. Fans on this type of draft job operate under severe conditions of heat and erosion. The ability of "Buffalo" I. D. Fans to stand up is one reason for their preference in many of the country's important installations.

On These Two Pages Are Some Recent Examples -

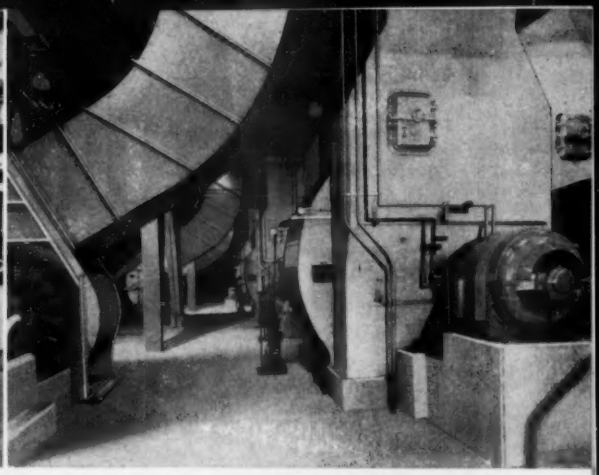
It is more than coincidence that "Buffalo" Draft Fans are serving in so many power plants. First, "Buffalo" Fans are built to take the punishment of draft service, as well as to deliver efficiently. Second, their accessible, bolted sectional construction facilitates servicing. Third, their performance characteristics are ideal for the intended draft service. Fourth, their factory - balanced rotors assure freedom from vibration. Have the plus-value of "Buffalo" Draft Fans in your plant.

***For More Efficient Combustion, Specify* "BUFFALO" DRAFT FANS**

"Buffalo" **MECHANICAL DRAFT FANS**



Interstate Power Company chose "Buffalo" Draft Fans for its Lansing Station, Lansing, Ohio. Shown here are two of the Induced Draft Fans in Lansing Station.



A battery of "Buffalo" Forced Draft Fans and Induced Draft Fans in a new station of a prominent power company. F. D. Fans are at left; I. D. Fans at right.

Chosen for HIGH COMBUSTION EFFICIENCY

Three "Buffalo" Induced Draft Fans being installed in a large southern power station. Same station also uses a high-capacity "Buffalo" Forced Draft Fan.

Select an

Rocking Contact VOLTAGE REGULATOR

For ANY Size GENERATOR!

Send for More Information!

Rocking Contact Voltage Regulators and *Regulex* Rotating Regulators are described more fully in bulletins and leaflets. Indicate those you'd like to have and give the coupon to your A-C representative, or send it to Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS,
Milwaukee 1, Wisconsin

Send me the leaflets and bulletins checked below:

- ☐ V-00 and 221 Regulators for small ac machines 14B6143A
- ☐ Regulators for medium size ac machines 14B6035
- ☐ Regulators for large ac machines 14B6015
- ☐ Regulators for dc machines 14B6137
- ☐ *Regulex* Rotating Regulators

Name ..... Title .....

Company .....

Address .....

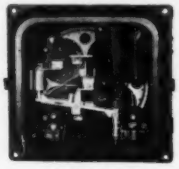
City ..... State A-3582

dc REGULATORS

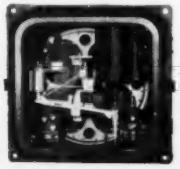
VD-00 Regulator for dc generators from 1 kw at 360 rpm to 75 kw at 3600 rpm. Front view, cover on.

VD-221 Regulator for dc generators from 1 kw at 164 rpm to 400 kw at 3600 rpm. Note *Rocking Contact* sector.

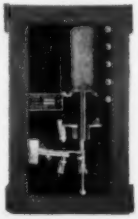
VD-2 Regulator for dc generators from 10 kw at 80 rpm to 2000 kw at 3600 rpm.



VD-3 Regulator for dc generators from 50 kw at 80 rpm to 7500 kw at 1200 rpm.

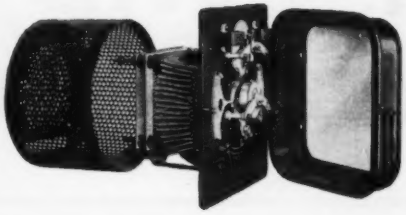


VD-4 Regulator is used on large dc machines. Note the four *Rocking Contact* sectors.



YD Regulator is used to control large dc machines requiring the use of a motor-operated rheostat. The control element is designed for panel mounting.

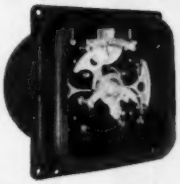
ac REGULATORS



All Allis-Chalmers mechanical regulators have *Rocking Contact* sectors sealed in the dust-tight front portion of the regulator housing. The smooth-working, carbon graphite sector face rocks on a curved silver-surfaced commutator . . . regulates with slight movement—reduces wear.

Ventilated rear section contains wire-wound resistance elements, each accurately designed according to the characteristics of your generating equipment and connected to a segment of the commutator.

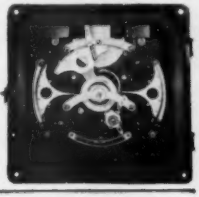
For Medium Size Generators



Type A Regulator for ac generators, 125 kva at 257 rpm to 1750 kva at 3600 rpm.

Type B Regulator for ac generators, 1000 kva at 257 rpm to 6250 kva at 3600 rpm.

Type C Regulator for ac generators from 3125 kva at 257 rpm to 25,000 kva at 3600 rpm. A, B, and C regulators have a guaranteed sensitivity of plus or minus 0.5 percent.



For Small Generators

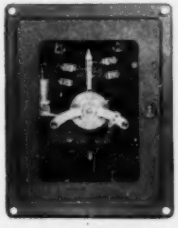
V-00 Regulator for ac generators up to 157 kva at 3600 rpm. Front view.

221 Regulator for ac machines from 188 kva at 720 rpm to 438 kva at 3600 rpm.

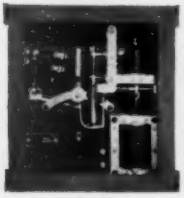
385 Regulator is temperature compensated for temperatures from 40 F to 150 F.

Shock-mounted V-00 Regulator for applications where vibration is a factor.

For Large Generators



Type J Element



Type JC Element

Type J Regulators consist of two parts: (1) a panel-mounting control element, and (2) a motor-operated rheostat.

Type J is an indirect-acting regulator for larger generator installations requiring pilot exciters.

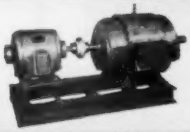
Type JC Regulators are specifically designed for Synchronous Condenser applications.

Motor-Operated Rheostat

ROTATING REGULATOR

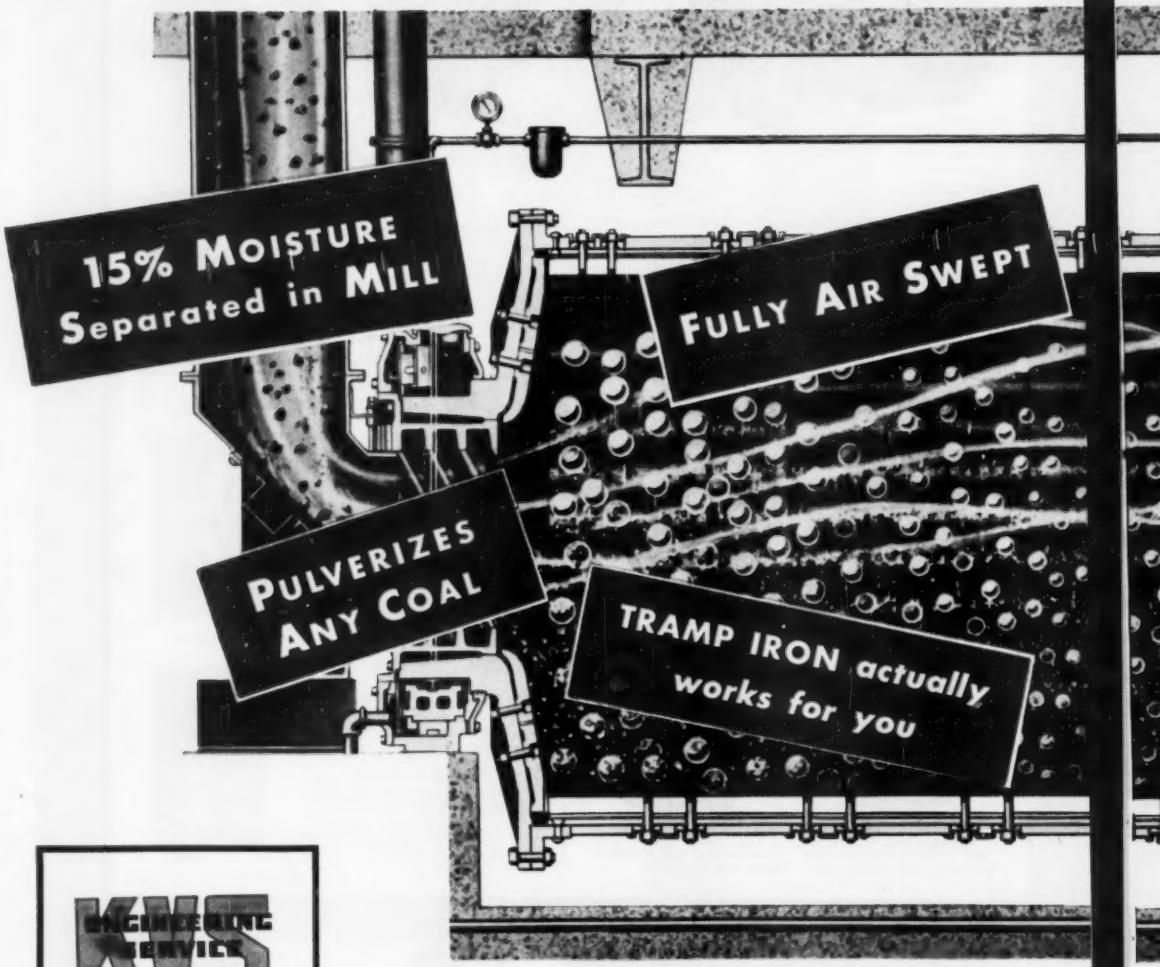
The *Regulex* Rotating Regulator is used on large machines. It consists of two parts: (1) a motor-generator set and (2) a control cubicle containing the static regulator elements. The *Regulex* exciter is similar to a dc generator in construction.

Regulex and Rocking Contact are Allis-Chalmers trademarks.



ALLIS-CHALMERS

INSIDE STORY OF THE KVS



KVS ENGINEERING SERVICE

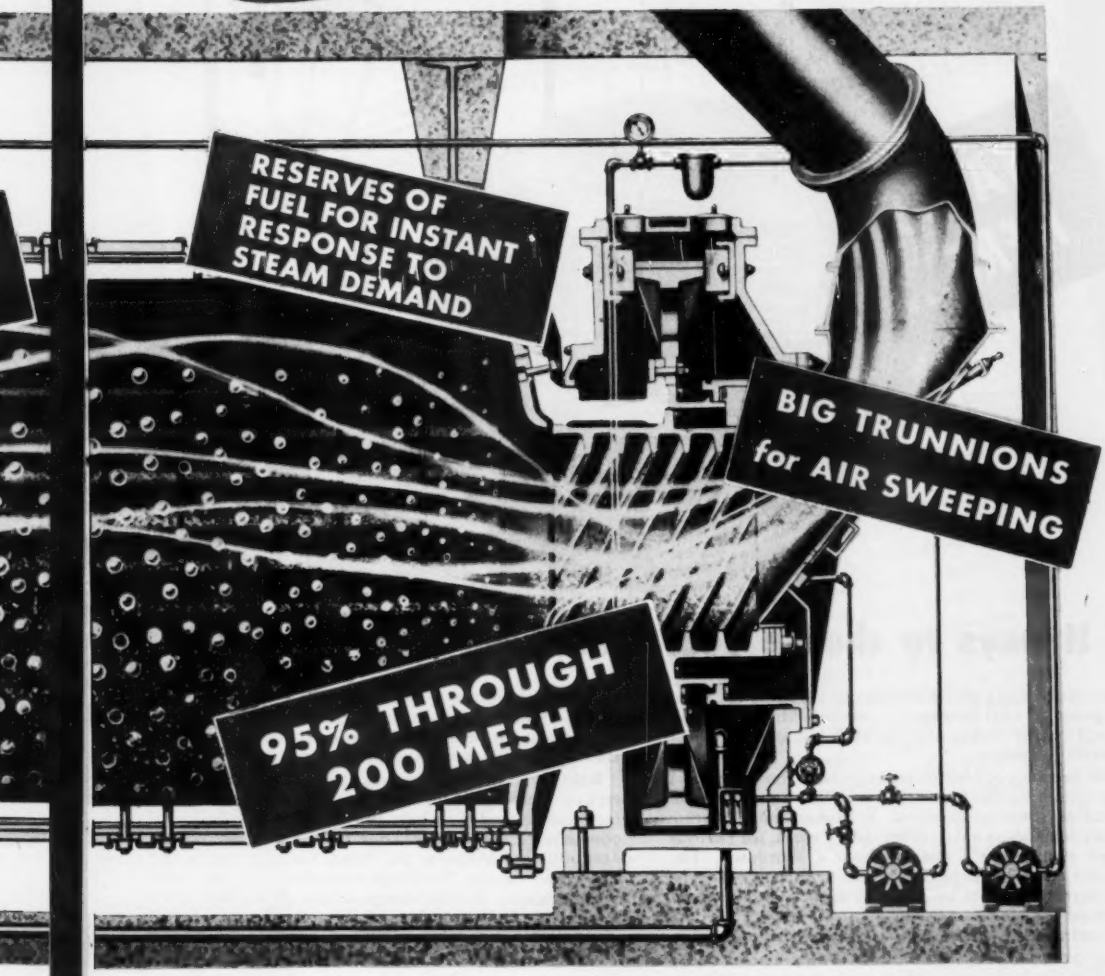
KVS is equipped to design and build complete power plants from "bunker to bus bar" in any part of the World and assume full responsibility for overall performance guarantees whether or not the equipment is built in KVS shops.

Any coal . . . in quantities to 35 tons per hour per mill . . . can be prepared as a superfine fuel, with complete control of firing rate assured, by providing your power plant with KVS pulverizing and firing equipment.

Moisture in the coal is released by hot air passing through the mill. Coal containing from 15% to 20% moisture is fired without the use of a separate dryer, directly from the mill without storage in bins or hoppers.

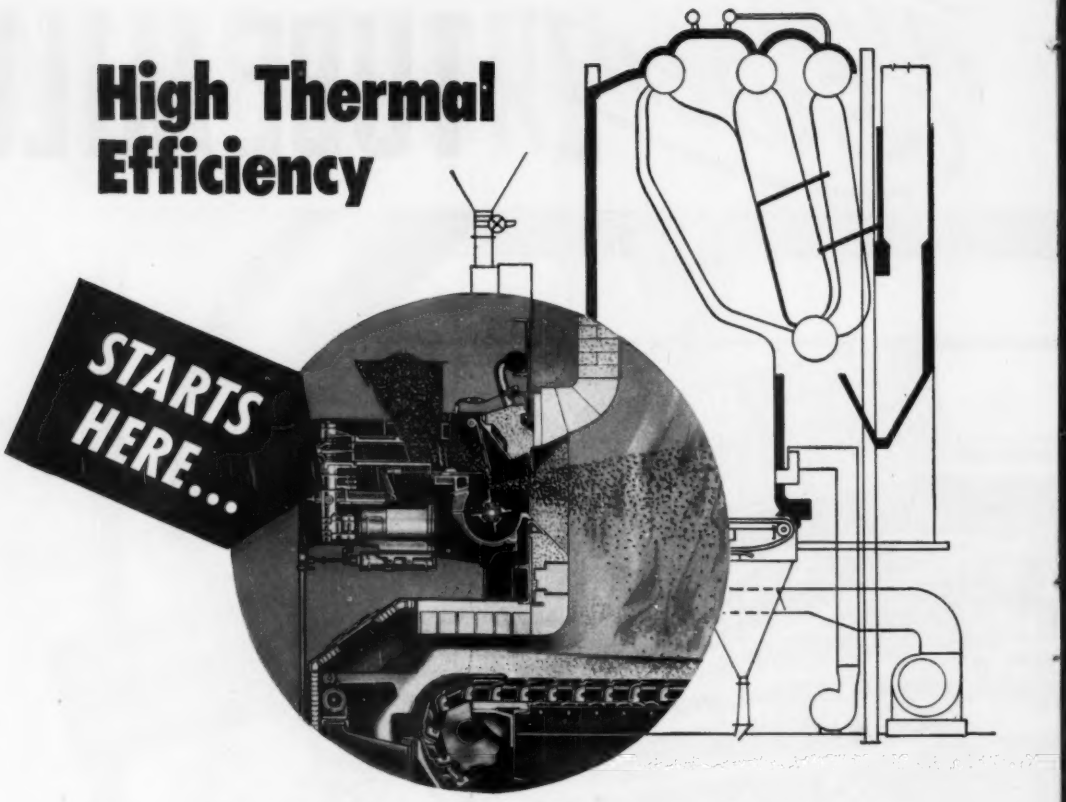
No magnetic separator is used. Tramp iron cannot damage KVS Air Swept Tube Mills but instead acts as grist and actually helps grind coal in the same manner as the Herculite balls.

AIR SWEPT TUBE MILL



Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVENUE • NEW YORK 16, N. Y.
FACTORIES: DANVILLE, PA.
CANADA • ENGLAND • FRANCE • AUSTRALIA

High Thermal Efficiency



It pays to choose your stoker carefully!

The coal-burning efficiency of your stoker is the starting point of coal saving . . . because the coal is all burned by the stoker and the coal bill is your major operating expense.

The burning of fuel for steam generation has always been one of the most exacting jobs that a machine can be called upon to perform. A stoker must operate twenty-four hours a day, seven days a week, for periods of six months or a year without a shutdown. The interior parts are exposed to heat and corrosion, the exterior mechanism to dirt and dust. A forced shutdown of the stoker may mean curtailment of production and cost the user many times the price of the stoker.

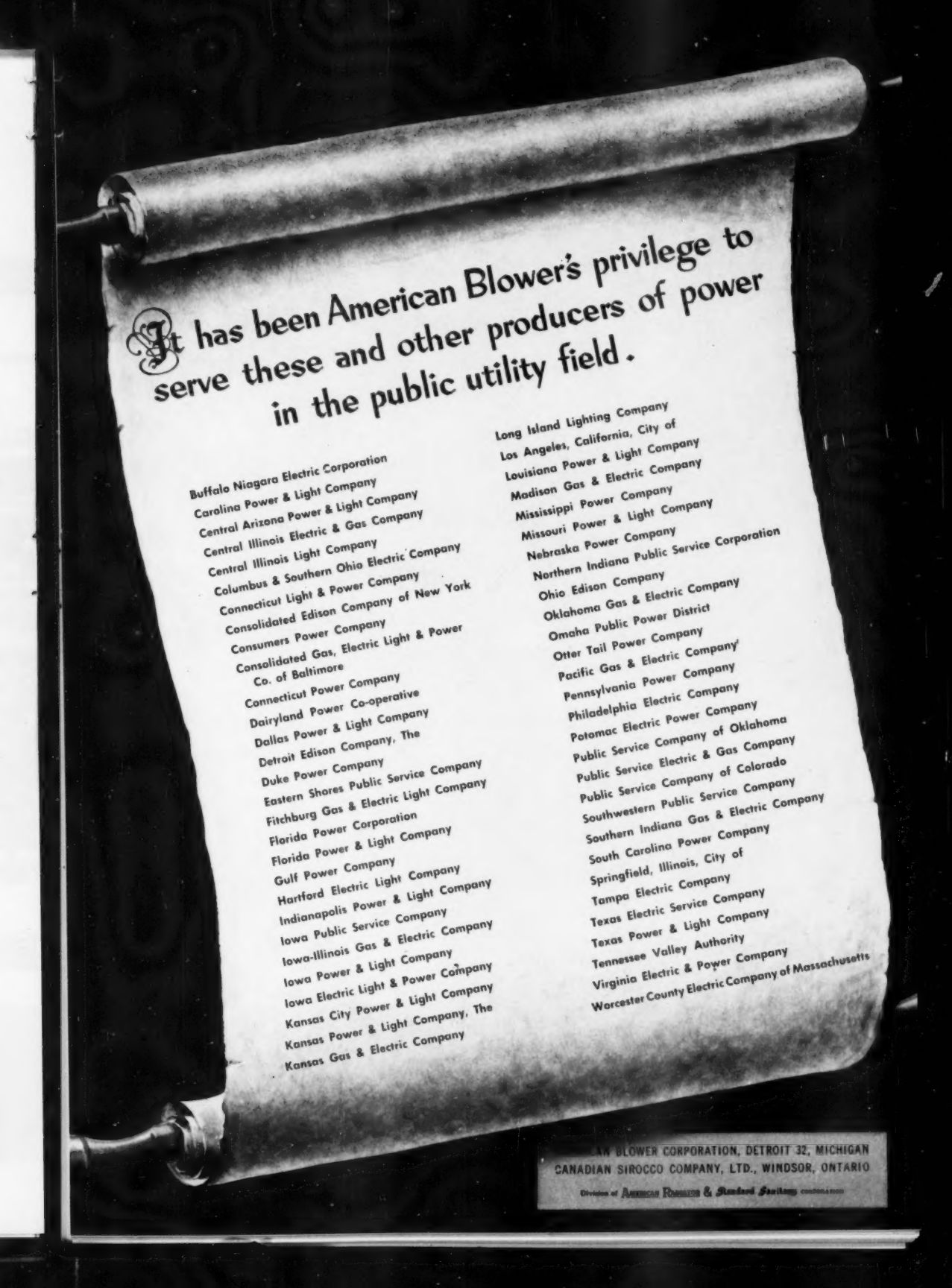
For over 60 years Westinghouse has maintained a consistently high standard of performance, while developing ever improved stokers to keep pace with the increasing demands of industry. And to make this assurance doubly sure, Westinghouse maintains a staff of experienced combustion engineers in all principal cities to make periodic inspections and give prompt attention to any operating problems.

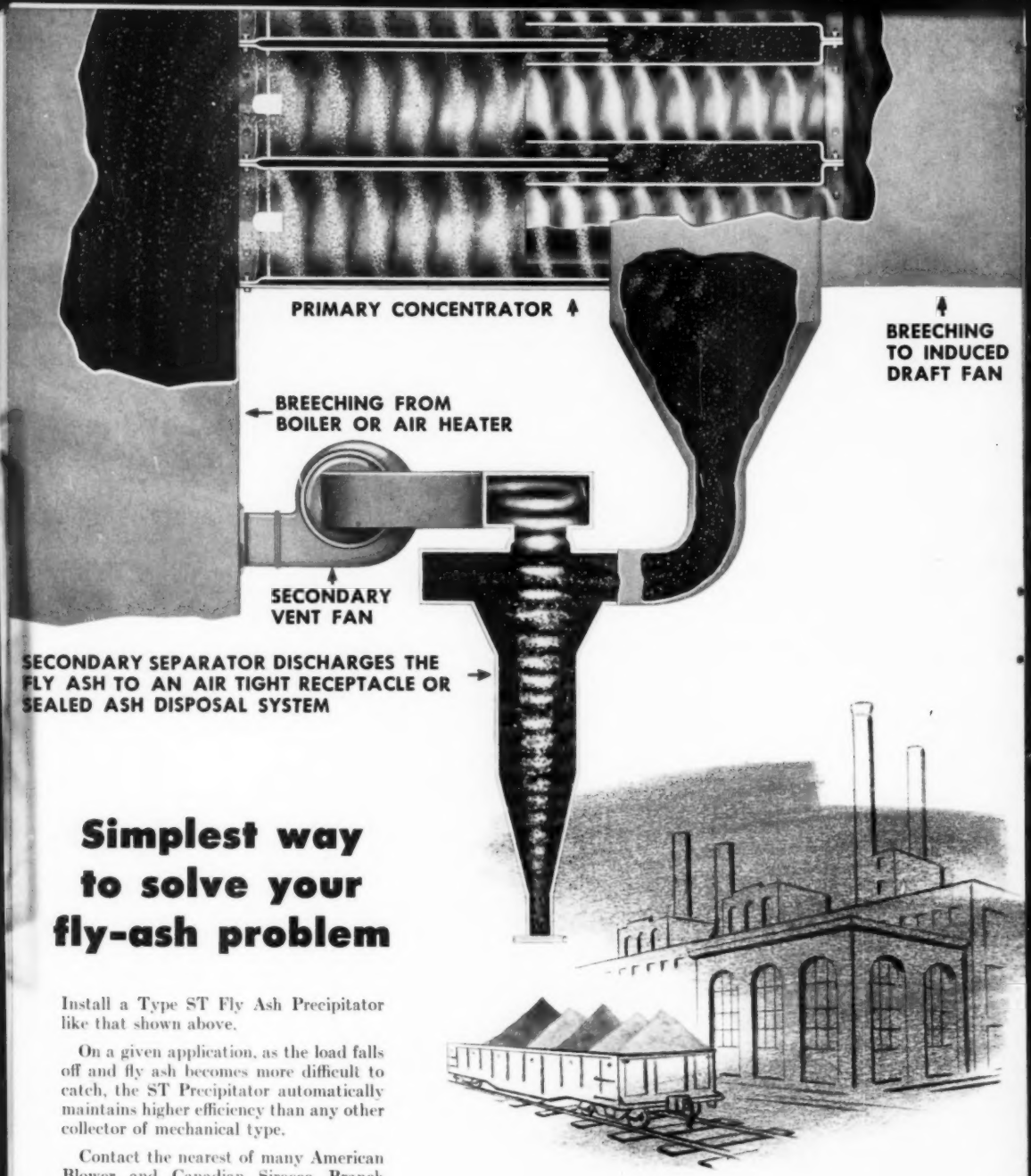
Before you invest, be satisfied you are buying the best stoker. Westinghouse offers a complete line of underfeed and spreader stokers for use with any boiler of your choice. Capacities range from moderate to over 400,000 lbs. of steam per hour. Get the full story. Call your nearby Westinghouse office . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50525

YOU CAN BE SURE...IF IT'S

Westinghouse

STOKERS


It has been American Blower's privilege to serve these and other producers of power in the public utility field.
Buffalo Niagara Electric Corporation
Carolina Power & Light Company
Central Arizona Power & Light Company
Central Illinois Electric & Gas Company
Central Illinois Light Company
Columbus & Southern Ohio Electric Company
Connecticut Light & Power Company
Consolidated Edison Company of New York
Consumers Power Company
Consolidated Gas, Electric Light & Power Co. of Baltimore
Connecticut Power Company
Dairyland Power Co-operative
Dallas Power & Light Company
Detroit Edison Company, The
Duke Power Company
Eastern Shores Public Service Company
Fitchburg Gas & Electric Light Company
Florida Power Corporation
Florida Power & Light Company
Gulf Power Company
Hartford Electric Light Company
Indianapolis Power & Light Company
Iowa Public Service Company
Iowa-Illinois Gas & Electric Company
Iowa Power & Light Company
Iowa Electric Light & Power Company
Kansas City Power & Light Company
Kansas Power & Light Company, The
Kansas Gas & Electric Company
Long Island Lighting Company
Los Angeles, California, City of
Louisiana Power & Light Company
Madison Gas & Electric Company
Mississippi Power Company
Missouri Power & Light Company
Nebraska Power Company
Northern Indiana Public Service Corporation
Ohio Edison Company
Oklahoma Gas & Electric Company
Omaha Public Power District
Otter Tail Power Company
Pacific Gas & Electric Company
Pennsylvania Power Company
Philadelphia Electric Company
Potomac Electric Power Company
Public Service Company of Oklahoma
Public Service Electric & Gas Company
Public Service Company of Colorado
Southwestern Public Service Company
Southern Indiana Gas & Electric Company
South Carolina Power Company
Springfield, Illinois, City of
Tampa Electric Company
Texas Electric Service Company
Texas Power & Light Company
Tennessee Valley Authority
Virginia Electric & Power Company
Worcester County Electric Company of Massachusetts
AN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Foundries & Standard Sanitary


PRIMARY CONCENTRATOR
BREECHING TO INDUCED DRAFT FAN
BREECHING FROM BOILER OR AIR HEATER
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

Simplest way to solve your fly-ash problem

Install a Type ST Fly Ash Precipitator like that shown above.

On a given application, as the load falls off and fly ash becomes more difficult to catch, the ST Precipitator automatically maintains higher efficiency than any other collector of mechanical type.

Contact the nearest of many American Blower and Canadian Sirocco Branch Offices, strategically located throughout the United States and Canada, for complete information on Type ST Fly Ash Precipitators.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

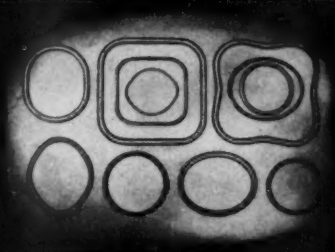
Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Seamless Asbestos Man hole and Hand hole.

Special Metal Odd Shaped Gaskets



Steel Armored Tube and Tube Cap

Folded Woven Hand hole and Man hole 600

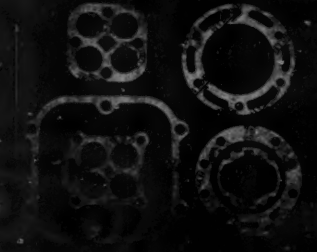
THE ANCHOR PACKING CO.

GASKETS

FOR EVERY INDUSTRIAL PURPOSE

Ankotalic Gaskets, Tube and Tube Cap

Gasket Tape Wound



Cut Hydroil

Corrugated Asbestos Filled Gaskets, Copper, Steel, Monel Metal, Etc.

BOILER GASKETS

Woven Asbestos Gaskets to fit practically every boiler made.

GASKETS CUT FROM SHEETS

Our gasket factory is prepared to supply gaskets of any shape, cut from a wide variety of gasket sheets to meet any requirements.

SPECIAL METAL GASKETS

Furnished to meet any special gasket problem.

Convenient Warehouse Locations with stocks for immediate shipment

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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69 West Jefferson Avenue 4 West 7th Street	Detroit 26, Michigan Cincinnati 2, Ohio
30 East Ohio Street	Chicago 11, Illinois
509 Washington Avenue	Houston 2, Texas
720 Mateo Street	Los Angeles 21, California
5575 Cote St. Paul Road	Montreal 20, Canada
418 Common Street	New Orleans 4, Louisiana
100 6th Avenue	New York 13, New York
401 North Broad Street	Philadelphia 8, Pennsylvania
405 Penn Avenue	Pittsburgh 22, Pennsylvania
Terminal Sales Building	Portland 1, Oregon
156 South Park	San Francisco 7, California
2207 1st Avenue South	Seattle 4, Washington
1407 Pine Street	St. Louis 3, Missouri
921 South Richmond Street	Tulsa, Oklahoma
524 Avalon Boulevard	Wilmington, California

that added touch—

to the

Foster Wheeler Heaters

"LOCKHEAD" CLOSURE

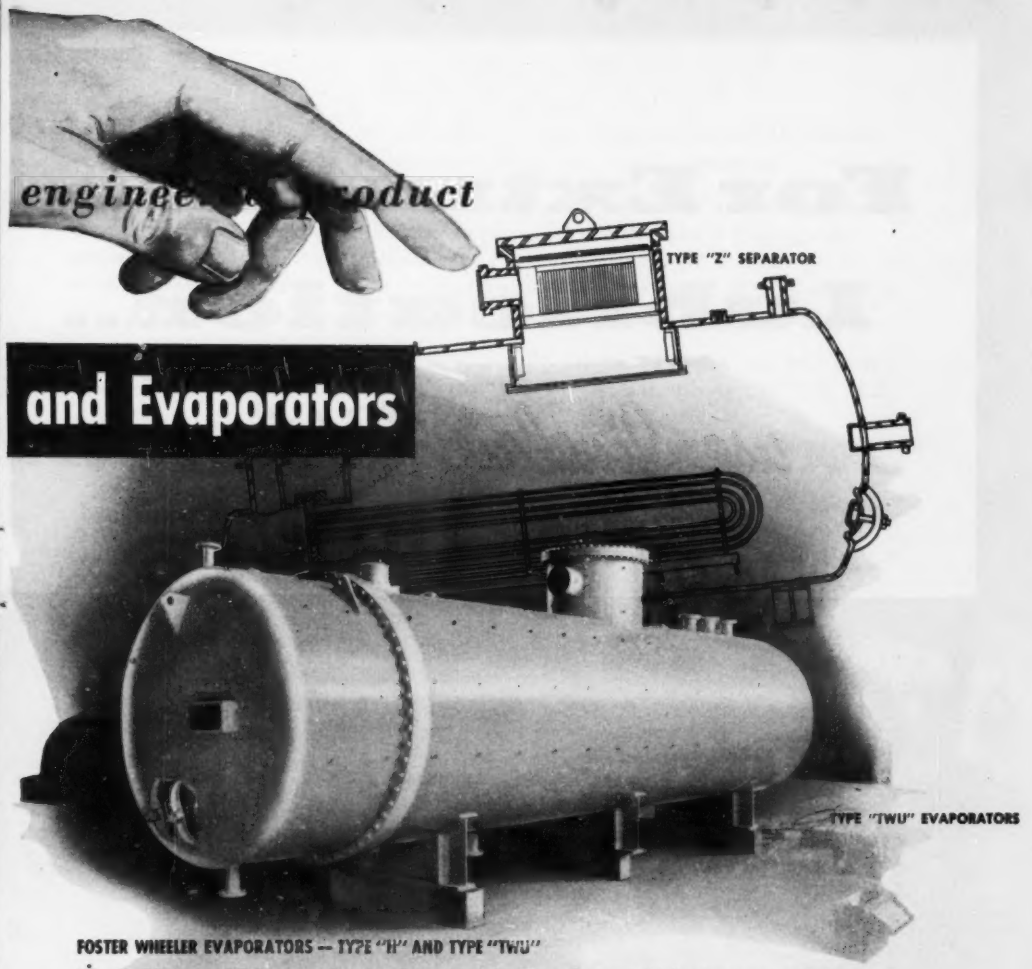
FOSTER WHEELER HIGH PRESSURE HEATERS WITH "LOCKHEAD" CLOSURES

Thousands of Foster Wheeler Feedwater Heaters giving optimum performance in steam-electric stations and industrial plants all over the country testify to the basic excellence of FW design.

In this case, "that added touch" is the FW "Lockhead" closure which provides separate means for supporting the head pressure load and the gasket compression load.

Foster Wheeler feedwater installations include units capable of handling boiler feed flow in quantities up to and in excess of 1,000,000 lb per hr and design pressures up to 3,500 psi.

For further information, write to:



and Evaporators

FOSTER WHEELER EVAPORATORS — TYPE "H" AND TYPE "TWU"

The "added touch" here is the development of a new design which gives you a choice in the selection of an evaporator ideally suited to your conditions. The design of evaporators for producing distilled water for central stations is basic to the efficient operation of a modern steam-electric power plant.

The FW Type "H" Evaporator was developed to handle raw and treated make-up and to give the best thermal and descaling operation.

The FW Type "TWU" Evaporator, a more recent design, is particularly adaptable to the production of pure vapor from properly treated make-up.

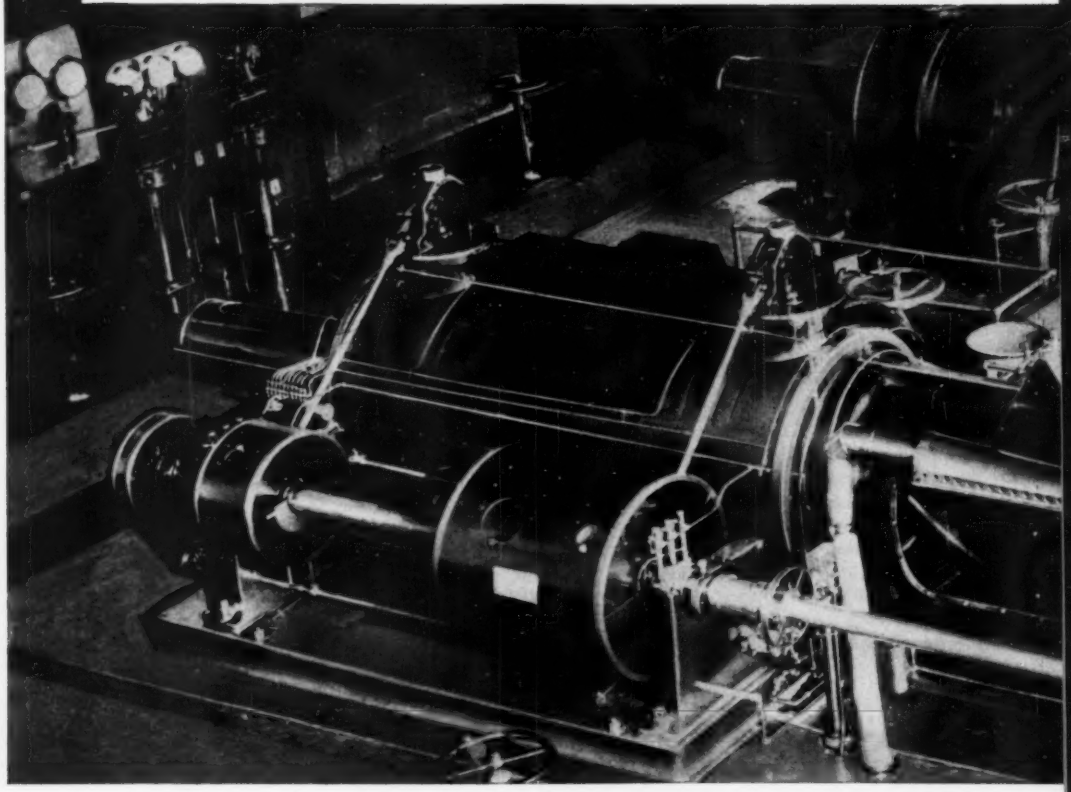
Both types are offered with the Type "Z" Separator which was developed during World War II to meet exacting requirements of vapor purity.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK, N. Y.

FOSTER WHEELER

For Extra Fine Lubrication..

use Sinclair Rubilene



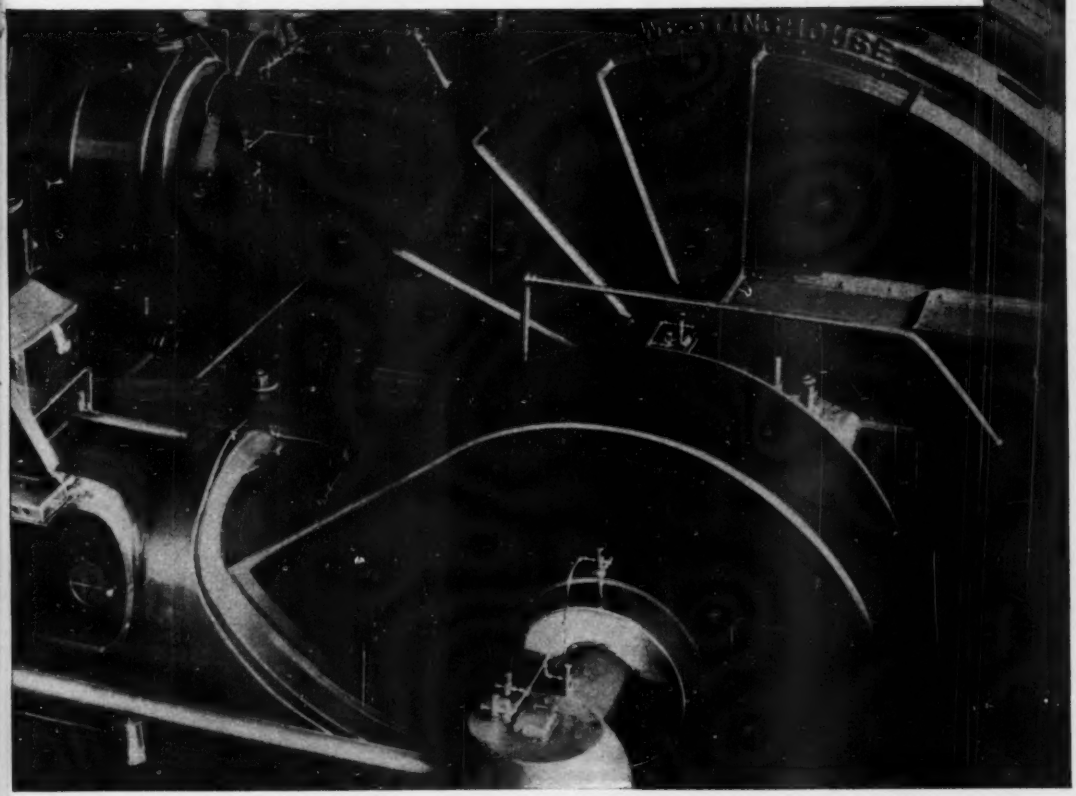
● Over many years engineers and plant operators have recognized Sinclair RUBILENE® as capable of rendering extra fine lubrication performance in the powerhouse.

Sinclair RUBILENE has always been a top-quality oil, as it has been constantly improved through the years, incorporating the latest technological developments in refining and processing. It resists oxidation under continuous high temperatures, and re-circulation. It separates rapidly from water, and is non-foaming. Through long periods of use it retains its original qualities, providing uniform, trouble-free lubrication and low maintenance costs.

Yes... RUBILENE's finer quality pays dividends. For lubrication counsel, see your nearest Sinclair Representative or write direct to Sinclair Refining Co., 600 Fifth Ave., N.Y. 20, N.Y.

SINCLAIR RUBILENE®

for low maintenance costs



d-c power in 2 minutes with an

Practically instantaneous starting is one of the many advantages you get by using the I-T-E Mechanical Rectifier. This source of low-cost d-c power in the 50 to 400 volt range can be on the line, operating at full load, within 2 minutes of the time the starting button is pushed. Even less time is required if the rectifier is not used in parallel with other types of d-c sources.

There are only 5 quick steps to starting—4 to stopping the equipment. These are easily performed by unskilled labor.

I-T-E Mechanical Rectifiers have no large rotating masses which must be brought up to speed before going on the line. No warm-up period is required—no waiting for vacuum build-up. This means the I-T-E Mechanical Rectifier has maximum availability for your process.

For further information, write I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pennsylvania. Ask for Bulletin 5106.

The 10,000 ampere mechanism pictured will supply d-c power to a chlorine cell line.

INSTALLATION IS FAST, TOO!

A complete installation can be unloaded, installed and placed in operation in a relatively short time. This is possible because of:

- Packaged delivery.
- Factory-wired and labeled control circuits.
- Truck-mounted, movable rectifying units.
- Overhead bus (no trenches or basement preparation).
- Compactness of the design.

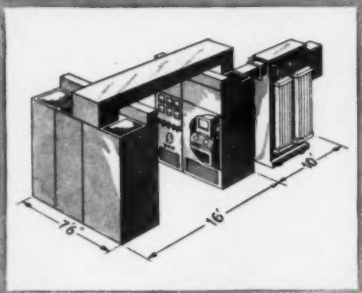
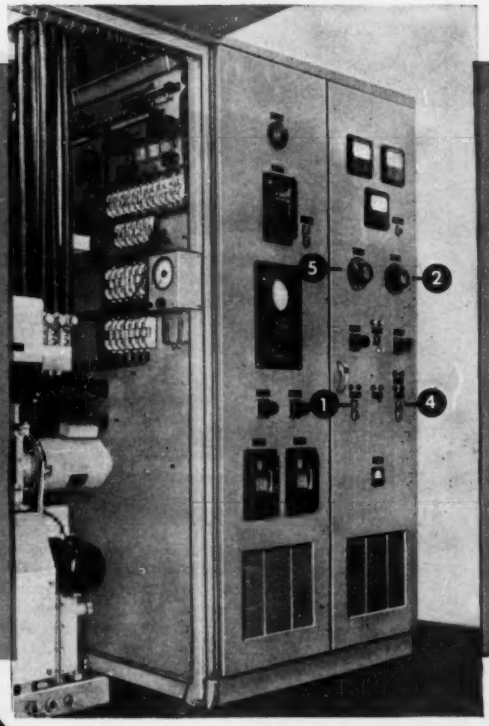


Diagram of typical mechanical rectifier installation. All elements of the unit including operating aisle are arranged in an area of 120 square feet. This does not include area occupied by transformer which is usually located outdoors.

I-T-E Mechanical Rectifier



All you do to start the
I-T-E MECHANICAL RECTIFIER

1. Push button to close a-c breaker.
2. Adjust d-c voltage to desired value.
3. Close d-c disconnect switch. (Not Shown)
4. Push button to close d-c breaker—you're on the line!
5. Adjust d-c current to desired value—automatic current regulator will hold that value—within ±1%!

I-T-E MECHANICAL RECTIFIERS OFFER THESE ADVANTAGES:

HIGH EFFICIENCY
96% or more in the 30 to 400 d-c voltage range.

SMALL SPACE REQUIREMENT
compact design, neat appearance.

LOW BUILDING INVESTMENT
no need for special foundation or unusual construction.

LOW INSTALLATION COST
put rectifier in place, connect, operate.

AVAILABILITY FOR SERVICE
no warming-up or speed-up period.

LOW MAINTENANCE COST
main contacts need only occasional replacement.

RUGGED TRANSFORMERS
conservative construction—latest design.

SIMPLE VOLTAGE CONTROL
voltage or current automatically controlled between ±1%.

I-T-E

MECHANICAL RECTIFIERS

I-T-E CIRCUIT BREAKER CO., 19th AND HAMILTON STS., PHILA. 30, PA.

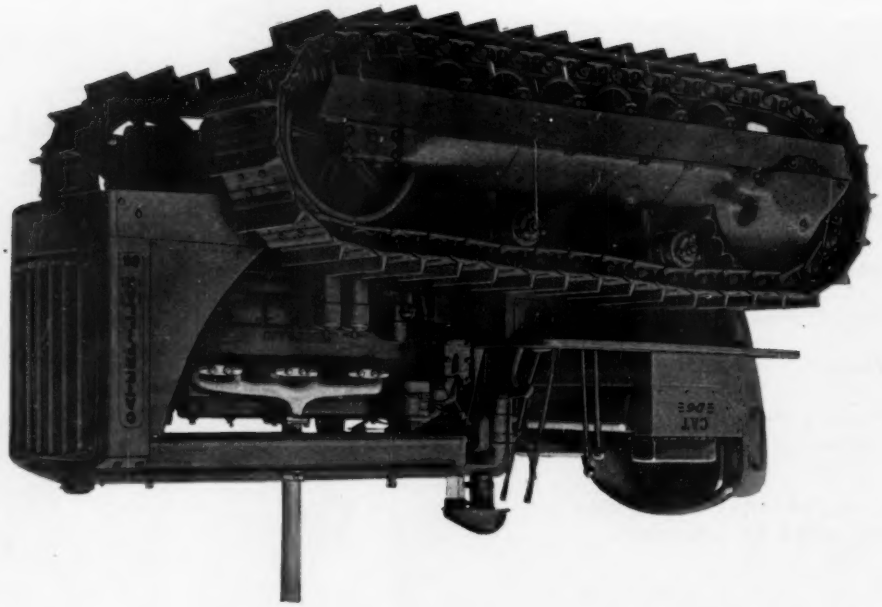
R&IE EQUIPMENT DIVISION, GREENSBURG, PA.

CANADIAN MFG. AND SALES: EASTERN POWER DEVICES, LTD., TORONTO

EXPORT SALES: PHILIPS EXPORT CO., NEW YORK 17, NEW YORK

WE TURNED A TRAC

to make the feeder that



WHEN CATERPILLAR TRACTOR CO., Peoria, Ill., recently installed two* Perfect Spread Stokers at its Joliet plant it had a very special reason for confidence. The same high traction principle that has been basic to Caterpillar's own success and leadership is employed in the AE conveyor feeder . . . and this principle assures 100% uniformity of spread; *absolutely prevents clogging on wet coal!*

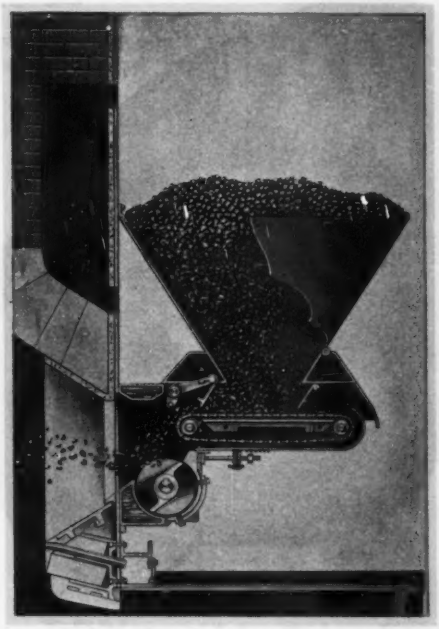
You can get Perfect Spread Stokers in a wide choice of sizes, capacities and grate types . . . but when it comes to the feeder there is only *one* choice. Every Perfect Spread Stoker is equipped with American Engineering's exclusive conveyor feeder . . . the feeder whose superiority is universally recognized and which assures true, *continuous* feeding whether operating at only 50 lbs. of coal per hour or at top capacity.

For most steam per fuel dollar, mail coupon on next page . . . today!

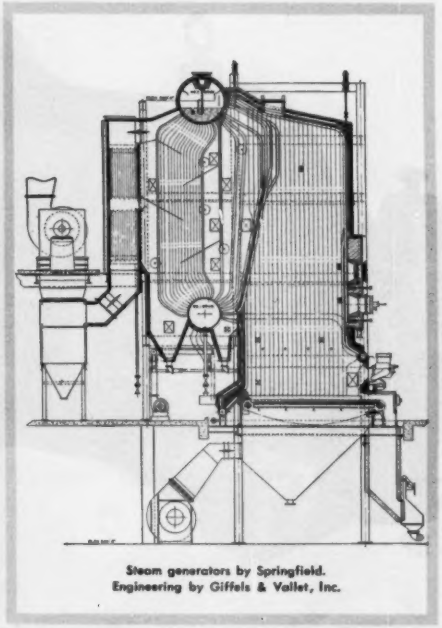
***A THIRD UNIT HAS BEEN ORDERED AND IS NOW BEING ENGINEERED.**

TOR UPSIDE DOWN

won't clog on wet coal



On Perfect Spread Stoker's traveling conveyor feeder a special mechanism drives feeder through a widely adjustable speed range – smoothly and continuously . . . Feeder unit protected against furnace temperatures by water and air cooling around furnace opening and rotor bearings . . . Special high-capacity spiral overthrow rotor distributes coal evenly over the entire grate surface . . . AE reinjection system features visible feed ejector hoppers, ejectors and nozzles of alloy iron. Complete reinjection unit serves every cinder drain point.



Steam generators by Springfield.
Engineering by Giffels & Vallet, Inc.

Cross section drawing showing arrangement of boiler components and some of the principal auxiliaries of the Perfect Spread Stoker installations at the Joliet plant of Caterpillar Tractor Co. The two boilers are designed to operate at 80,000 lbs. per hour continuously, with a peak rating of 90,000 lbs. per hour for a two-hour period. Stokers are 12' wide by 14' 3" long, center to center sprockets. Each stoker has three feeders; 171 sq. ft. total grate area with 150 sq. ft. active area; and each is operated by a 1½ hp. 1800 r.p.m. electric motor.

AE

AMERICAN ENGINEERING

COMPANY

PHILADELPHIA 25, PENNA.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hole-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2400 Aramingo Ave., Philadelphia, Penna.

Gentlemen: – We are interested in getting top efficiency from both low and high ash coals. Please send us full information about Perfect Spread Stokers.

☐ Also send us complete story of *Caterpillar Installation.*

Name..... Title.....

Company .....

Address .....

City ..... Zone..... State.....

General Electric Announces

A NEW ADVANCE IN

type DP

Custom Performance from Standard Turbine Drives now possible through new Designs and Manufacturing Methods

Now you can select the mechanical-drive turbine that will give you maximum mechanical power for your fuel dollar . . . and without the delay and expense of special engineering. General Electric's four new multi-stage drives are *standards,* designed to meet your *specific* requirements.

Four new governing systems give you a wide selection of performance ratings. A new sectional valve gives you greater efficiency for part load operation. Many other improvements make these the finest turbines of their size General Electric has ever produced.

Secret of their adaptability is in the method of manufacture. By using interchangeable casting patterns, designed to be combined in a variety of ways, it's possible for the factory to "customize" standard machines for individual applications. You get a better turbine, designed for your job, and the delivery time is shorter, the cost lower.

Get the full particulars on these new multi-stage turbine drives. Write for our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." General Electric Company, Section 252-53, Schenectady, N. Y.

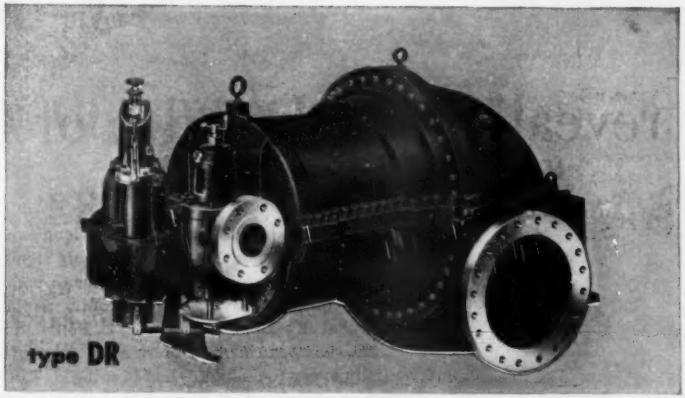
GENERAL ELECTRIC

252-53

MULTI-STAGE TURBINE DRIVES

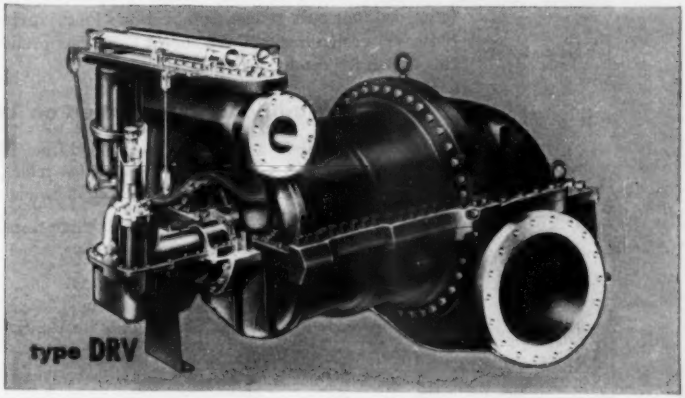
type DP

Dependable power over a 30 per cent adjustable speed range.



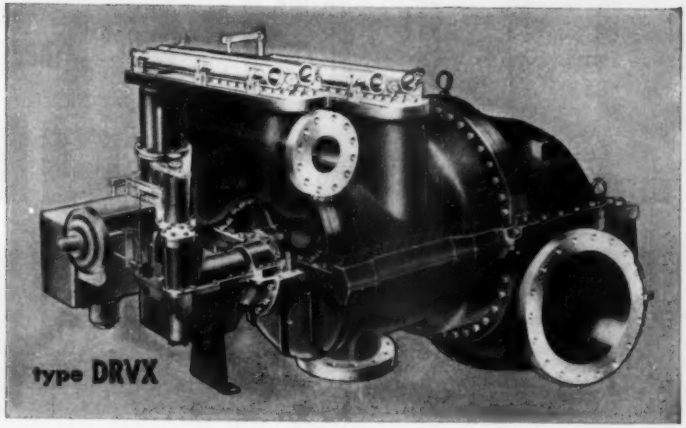
type DR

Oil-relay governor makes possible a speed range of 6 to 1, with only 4 per cent regulation and ½ per cent steady state speed variation.



type DRV

Automatic sectional valves linked to the oil-relay governor minimize throttling losses under fluctuating load factors, make possible substantial operating savings.



type DRVX

For applications where process steam is desired at a definite, steady pressure. Extracted steam pressure remains constant even when load on the unit fluctuates and the flow of extracted steam varies.

The VU Story

revealing the breadth of C-E's current

When you buy a boiler the manufacturer's long experience is a very important consideration, and Combustion has that. But even more significant is *current* experience . . . experience in meeting steam requirements similar to yours. And Combustion has that, too.

Here is a comprehensive picture of contracts placed for C-E Vertical-Unit Boilers during 1951. What it adds up to is that VU Boilers have nationwide and worldwide acceptance . . . that 1951 contracts represent a full range of capacities, pressures and temperatures and virtually every fuel and method of firing.

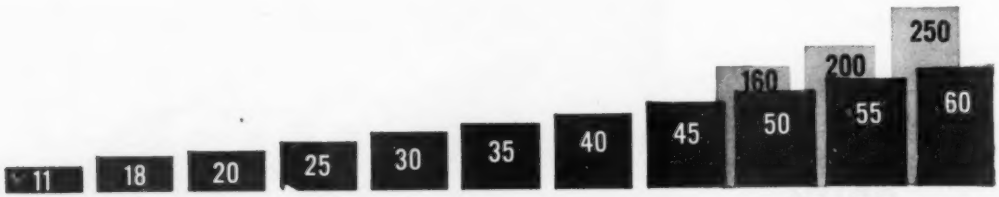
So you can select a C-E Vertical-Unit Boiler with complete assurance that your installation will not only reflect Combustion's long experience—more than 20 years—with the basic VU design but will also reflect C-E's comprehensive *current* experience in applying this design for conditions identical to yours.

Additional information on 1951 VU contracts

FUELS AND FIRING—Bituminous coal as supplied from all principal mining areas; also anthracite, lignite, oil, gas, bagasse, bark, wood and various refuse fuels. All present-day methods of firing and types of firing equipment are represented including combination firing of two or more fuels.

GEOGRAPHICAL—Units ordered during 1951 will be installed in 27 states, in seven Latin American countries and in Africa, Arabia, Australia, Canada, Israel and Spain.

INDUSTRIES—Automobile, Brewing, Building Materials, Cement, Chemical, Food Products, Government, Institutions, Lumber, Machinery, Metal Mfg., Mining, Paper, Petroleum, Public Utilities, Railroads, Rayon, Rubber, Shipbuilding, Soap, Sugar and miscellaneous manufacturing. B-559



COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

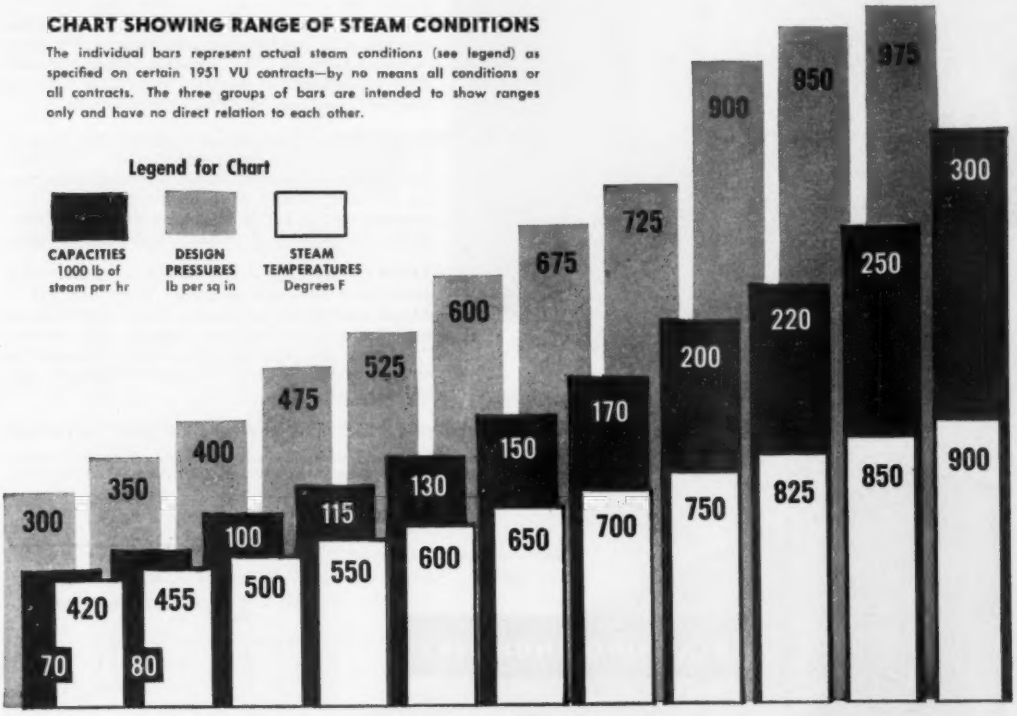
for 1951

experience in the application of

C-E VERTICAL-UNIT BOILERS

CHART SHOWING RANGE OF STEAM CONDITIONS

The individual bars represent actual steam conditions (see legend) as specified on certain 1951 VU contracts—by no means all conditions or all contracts. The three groups of bars are intended to show ranges only and have no direct relation to each other.

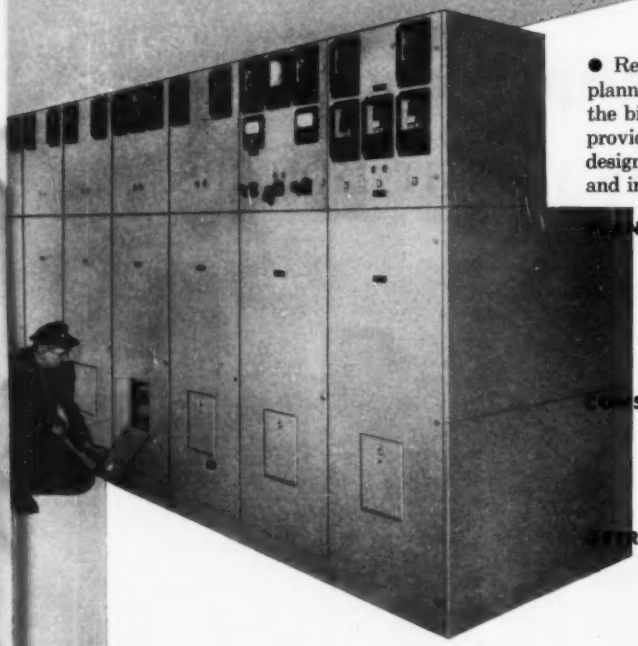


— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

I-T-E METALCLAD SWITCHGEAR



● Regardless of your engineering responsibility—planning, construction, or operation—you'll welcome the big advantages that I-T-E Metalclad Switchgear provides. Since 1937 the soundness of the I-T-E design has proved itself in central stations, steel mills, and industrial plants the world over.

PLANNING: Planning engineers, concerned with plant wide equipment protection problems in new and expanded distribution systems, prefer I-T-E Metalclad Switchgear because for 15 years, it has assured safe, positive arc interruption. Planning is easier because I-T-E supplies indoor and outdoor equipments in standard structures that are compact, uniform, and readily expandable.

CONSTRUCTION: Construction engineers like the way I-T-E speeds switchgear installation. I-T-E forwards channel bases in advance, so that floors can be prepared ahead of equipment arrival. The arrangement of I-T-E Metalclad Switchgear simplifies the pulling of primary and control cable.

OPERATION: Operating engineers have to live with switchgear once it's in place. They like I-T-E Metalclad Switchgear because double interlocking makes it safe and easy to operate. The famous "fast-test" feature makes short work of secondary circuit testing—even eliminates opening the breaker door.

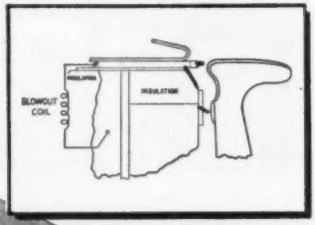
4160 VOLTS • 50,000 AND 150,000 KVA INTERRUPTING • 600, 1200, AND 2000 AMPERES CONTINUOUS

For information, including selection and application data, write for Catalog Section 7004 and Bulletin 7000-A. I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pennsylvania.

PLANNING ENGINEERS

I-T-E Metalclad Switchgear provides safe, positive arc interruption because I-T-E Type HV circuit breakers are used throughout.

When opening short circuit current near rating, the I-T-E HV breaker interrupts the current so quickly that the moving contact travels only about one inch before the circuit is interrupted. Extra contact travel is provided for interruption of very low current.



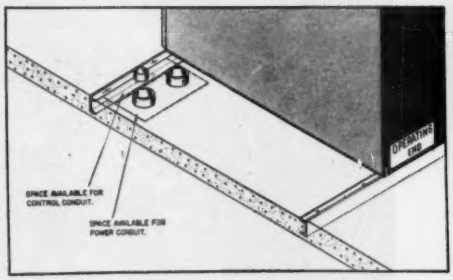
LONG-LIVED INTERRUPTING ABILITY

Arc transfer energizes blowout coil and eliminates metallic connection between front runner and lower current stud. Thus, potential is across arc chute only during arc interruption—resulting in longer chute life.

PROVES ITS ENGINEER APPEAL

CONSTRUCTION ENGINEERS

I-T-E provides switchboard floor plans, front view drawings and single line diagrams well ahead of shipment. When you're ready, I-T-E forwards channel bases—your equipment goes in right on schedule! Control and primary cables can enter structure at top or bottom. Control cable connections are located just inside the removable rear panel. You have them completely accessible for inspection and checking *without* de-energizing the circuit, *without* removing the breaker, *without* entering the switchgear structure.



OPERATING ENGINEERS

Important operating advantages of I-T-E Metalclad Switchgear save steps and guard your safety. Here are just a few of them:

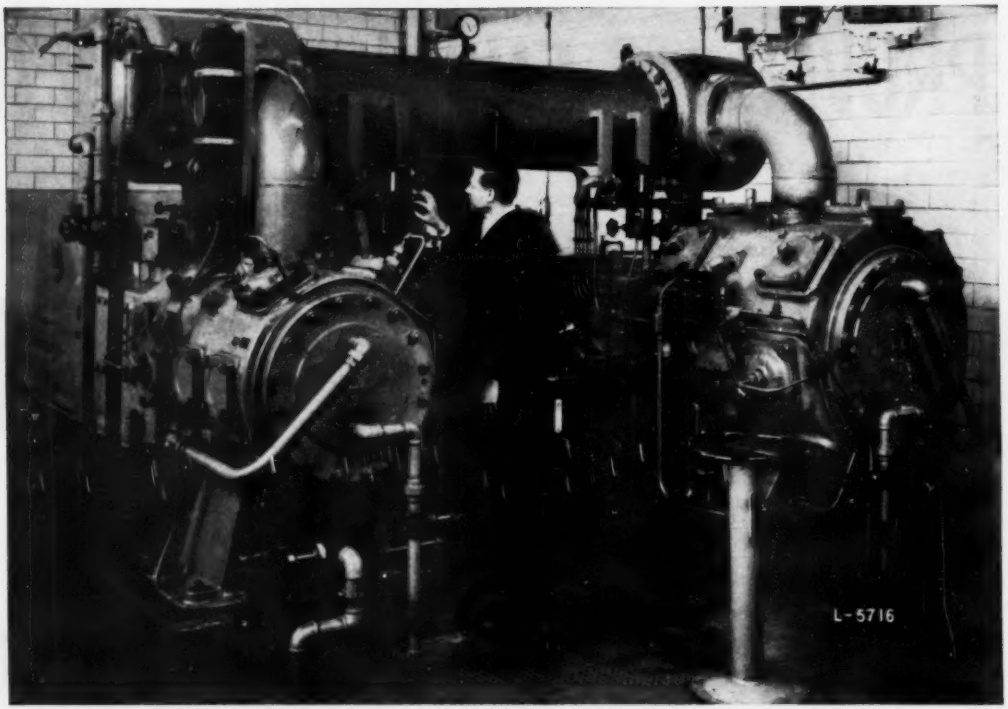
1. Secondary circuit testing without removal of breakers from the stationary structure. No separate operation of secondary disconnecting devices is required.
2. The double interlock assures complete safety of personnel and equipment—guards against improper insertion or withdrawal of the circuit breakers. Interlocks are built into the circuit breaker—eliminating complicated engagement mechanisms between the breaker and structure. Adjustments are simplified and interchangeability is assured.
3. Circuit breaker control-relay is mounted on breaker truck; (when breaker comes out, relay comes out. No "climbing" into structure to inspect control-relay).
4. Truck-mounted horizontal removable elements eliminate hours of maintenance usually required for complicated elevator mechanisms.

Full operating positioning is accomplished by mechanical racking.

Specify I-T-E **METALCLAD SWITCHGEAR**

I-T-E CIRCUIT BREAKER CO. • 19th & HAMILTON STS. • PHILA. 30, PA.

R&IE Equipment Division, Greensburg, Pa. • Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N.Y. 17, N.Y.



WORTHINGTON DC2 HORIZONTAL AIR COMPRESSOR at Jeffrey Manufacturing Co., Columbus, Ohio

Worthington air helps build Jeffrey mining and material handling equipment

This Jeffrey installation at Columbus, Ohio, typifies the best and most efficient in Compressed Air Equipment.

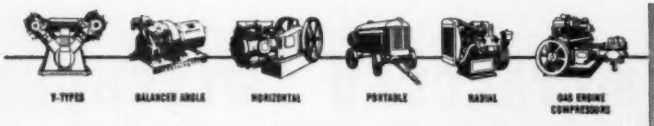
Equipped with Worthington's Five Step Bypass Capacity Control, the compressor requires *less* horsepower and *less* maintenance because of:

1. Reduced operating temperature at part loads.
2. Reduced part-load power consumption.
3. Reduced cylinder and ring wear because of improved lubrication.
4. Reduced carbon deposits on valves.

Jeffrey also operates a Worthington 350-hp steam driven compressor, a 10-hp single horizontal for soot-blowing, and a 10-hp vertical compressor for instrument air.

For dependable, efficient compressed air requirements, always specify Worthington. Write for Bulletin L-675-B1B to Worthington Pump and Machinery Corporation, Compressor Division, Buffalo 5, New York.

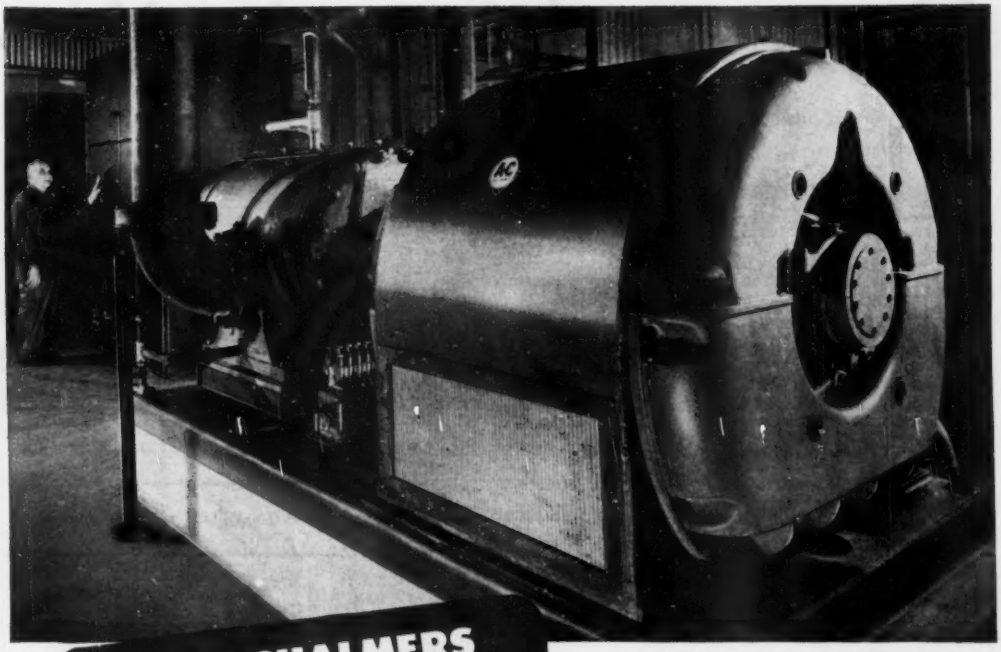
K.1.16



No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors



All Allis-Chalmers installation: 250-hp, 495-rpm, drip-proof cage motor; single-stage rotary compressor; controller.

ALLIS-CHALMERS Large Motors ... Provide Low-Maintenance Reliability

START with construction features that have already earned a reputation for ruggedness and reliability. Add all-around drip-proof and mechanical protection. And do this without sacrificing accessibility for routine maintenance.

That's how Allis-Chalmers large cage motors were redesigned. That's why you'll want these advantages in your new motors:

IMPORTANT FEATURES

● Rigid cast-iron end shields assure you of correct bearing alignment and corrosion resistance as well as drip-proof protection.

● Capsule-type bearing housings enable you to leave the bearings and oil supply sealed against abrasive dirt when you remove the top halves of the end shields to clean the windings.

● Large air discharge openings in the yoke invite you to keep the ample passages back of the stator core clean and unobstructed. They also make installation easier.

● Louvers on air discharges and design of intakes keep foreign objects out of the motor.

A-3561

NEW BULLETIN

Built in ratings from 60 hp at 300 rpm to 1750 hp at 1800 rpm, these cage motors are described in detail in bulletin 05B7542A. Ask your nearby Allis-Chalmers representative for a copy, and see for yourself why these redesigned motors provide a new low in maintenance and a new high in reliability. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Do you have boiler like these?

Here are 8 "case histories" telling how leading companies solved their boiler plant problems. You'll note that there are small boilers and large boilers—all types of fuels, including alternate fuels—different load characteristics—and different uses for steam.

The two things all these plants have in common are HAYS COMBUSTION CONTROL and a record of continuing excellent results—top efficiencies, greater capacity, high CO_2, reduced fuel, labor and maintenance expense, etc.

In each boiler plant, Hays instruments and control were tailored to the specific conditions and requirements . . . "packaged" in a handsome panel . . . and engineered for the results desired.

Here's how to find out the details which can help you in solving your boiler plant problems. Select the "case history" which is close to your conditions and requirements—and then check the attached coupon. You'll get complete factual details of the boilers and related equipment, load characteristics, fuels, and fuel handling, as well as an explanation of the operation of the control system complete with schematic drawings.

get these factual

RESULTS STORIES

	To recondition or add new boiler To get better process load regulation	To get better efficiency. To get more out of boiler due to rising load
	AMERICAN TOBACCO COMPANY	RAYBESTOS-MANHATTAN COMPANY
BOILERS	Three (one stand-by)	Four
RATING	16,500 lb per hr	19,650 lb per hr
LOAD SWINGS	Total fluctuation up to 20,000 lb per hr	Moderate load swings
FUEL	Coal	Coal
STEAM USE	Power and process	Process pumps, compressors and heating
results	"The Hays instruments and controls through greater efficiency . . . gave us the solution . . . that of increasing steam capacity and accurate automatic control of the load."	"Our basic reason for installing the Hays Control was to obtain better efficiencies. Our aim was more than reached . . . efficiency . . . 79.3%."

American Tobacco Co.

Raybestos-Manhattan Co.

THE **HAYS** CORPORATION
MICHIGAN CITY 3, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

plant problems

To make possible easy future expansion with maximum fuel flexibility	To lower operating costs while handling load fluctuations	To modernize plant and to increase boiler plant efficiency	To get accurate control of pulverized coal and oil firing through load swings	To meet varied manufacturing demands and to achieve savings in fuel and labor	To get greater capacity while operating at top efficiency
A. B. DICK COMPANY	SUNSHINE BISCUIT COMPANY	FALSTAFF BREWING CORPORATION	BEMIS BROS. BAG COMPANY	BALDWIN LOCOMOTIVE WORKS	SCOVILL MFG. CO.
Three	One, plus steam generator incinerator	One	Two	Three	Two
25,000 lb per hr each	31,500 lb per hr	48,000 lb per hr	70,000 lb per hr and 80,000 lb per hr	160,000 lb per hr	One 225,000 lb per hr One 150,000 lb per hr
5—10,000 lb per hr fluctuation without warning	Daily variation 20,000 lb per hr	Fluctuates 12,000 to 28,000 lb per hr	Daily variation 15,000 lb per hr	Intermittent, no warning swings up to 100,000 lb per hr	Load swings up to 60,000-70,000 lb per hr
Coal or gas	Oil	Coal	Oil and coal	Coal and oil	Coal and oil
Heating and process	Process	Heating and process	Power, process and heating	Heating and process	Power, heating and process
"Because of its simplicity (Hays Combustion Control) has enabled us to change quickly from coal to gas firing... aided us to achieve 73% efficiency rating in winter—71% in summer."	"Our management and operating crew are well pleased with the new (Hays) unit ...low maintenance costs... equipment enables us to keep close watch over our operating costs."	"Our boiler is operating at 82% efficiency and our maintenance expense bill has been cut 65%...our fuel bill has decreased by several hundred dollars per month."	"We have made test runs using the Hays Automatic Combustion Control System, bringing the load rapidly up from 8,000 lb per hr to 80,000 lb per hr with excellent results."	"Our Hays Combustion Control System has aided us substantially in cutting our fuel, labor, and maintenance expense... saved 30,000 tons of coal per year ...we operate with 42 less men than were formerly used."	"We are meeting steam demands up to 400,000 lb per hr achieving an evaporation rate of 12.8, a fuel cost per kw of $.0049, and a cost per 1,000 lb of steam of $.706."

A. B. Dick Company

Sunshine Biscuit Co.

Falstaff Brewing Corp.

Bemis Bros. Bag Co.

Baldwin Locomotive Works

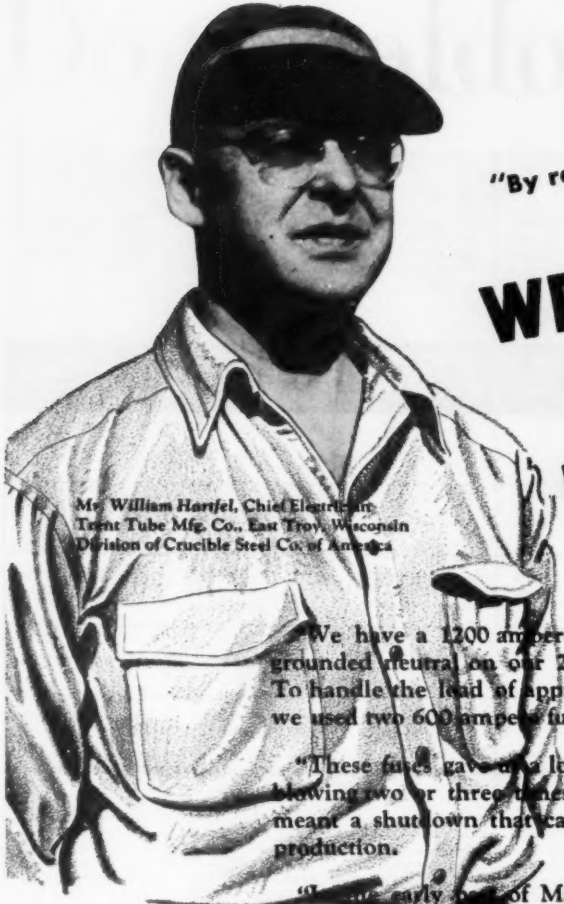
Scovill Mfg. Co.

The Hays Corporation, Michigan City 3, Indiana
I've checked the RESULT STORY(S) that cover the conditions in my plant. Please send it immediately.

- ☐ American Tobacco Co.
- ☐ Raybestos-Manhattan Co.
- ☐ A. B. Dick Company
- ☐ Sunshine Biscuit Co.
- ☐ Falstaff Brewing Corp.
- ☐ Bemis Bros. Bag Co.
- ☐ Baldwin Locomotive Works
- ☐ Scovill Mfg. Co.

Name_____ Address_____

Title_____ City & State_____



Mr. William Hartfel, Chief Electrician
Trent Tube Mfg. Co., East Troy, Wisconsin
Division of Crucible Steel Co. of America

"By replacing ordinary fuses with Fusetron fuses

WE WIPED OUT NEEDLESS FUSE BLOWS

"We have a 1200 ampere switch with a grounded neutral on our 220 volt, 3 phase system. To handle the load of approximately 1000 amperes, we used two 600 ampere fuses in parallel.

"These fuses gave us a lot of trouble by blowing two or three times a week. Each blow meant a shutdown that caused a loss in production.

"In the early part of May, about two months ago, we decided to try out Fusetron dual-element fuses.

"These fuses completely wiped out needless fuse blows and what is more important they eliminated the costly interruptions of operating schedules."

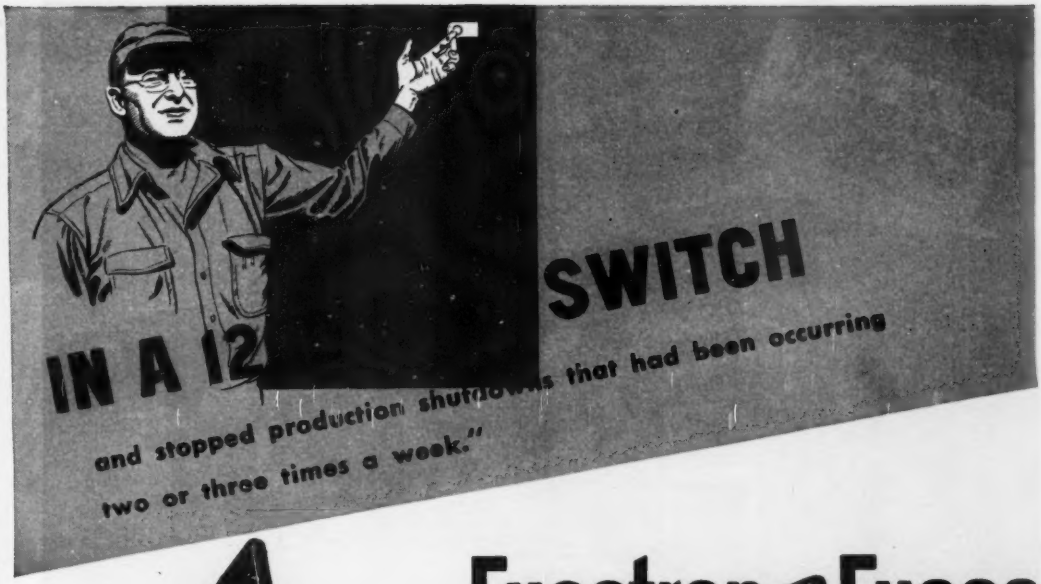
Don't Risk Losses in Your Plant

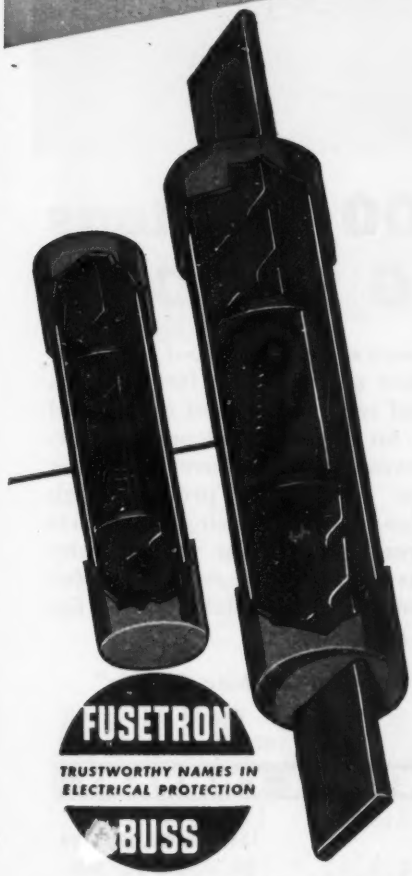
One **needless** shutdown — One **lost** motor
One **destroyed** panel or switch
One **burned out** solenoid

May cost you more than replacing every ordinary fuse with a FUSETRON dual-element Fuse.

But, simply knowing that FUSETRON fuses do save money is knowledge — but it isn't action.

By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses, you have action that begets money saving.





Fusetron DUAL ELEMENT Fuses

Provide NOT ONLY SHORT CIRCUIT *But* 10 Point Protection

1. Protect against short-circuits.*
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating—lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

*Fusetron fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

Send the Coupon for more facts

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.)
Please send me complete facts about FUSETRON dual-element Fuses.

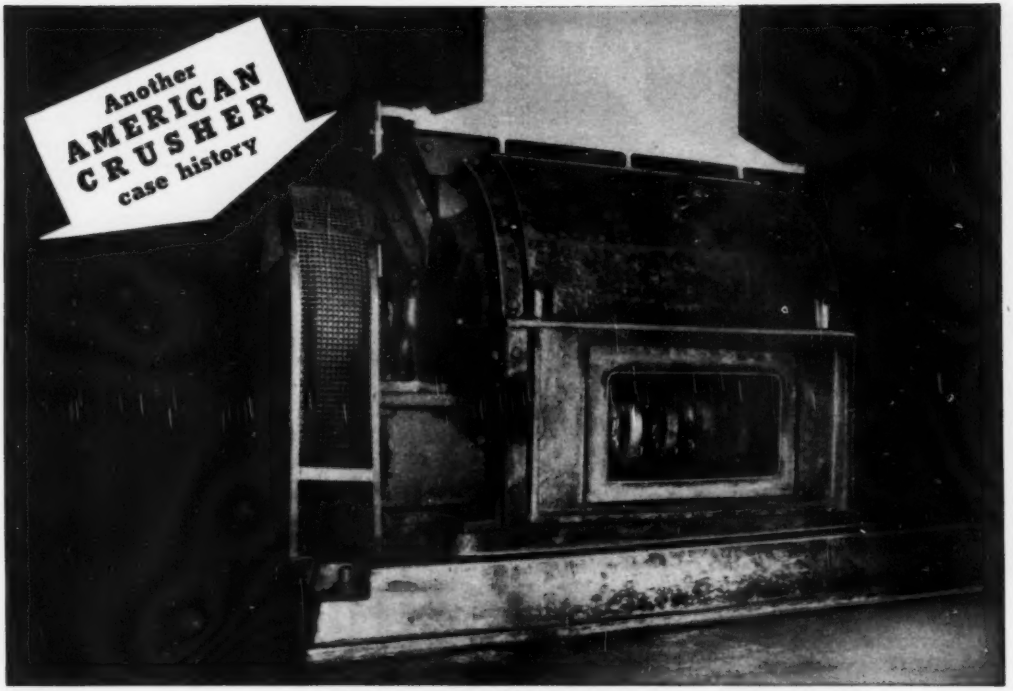
Name _____ Title _____

Company _____

Address _____

City & Zone _____ State _____ 352

(Fusetron is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)



20 years ... and 6,000,000 tons later: STILL GOING STRONG

Yes, over 2 decades ago this American Crusher 42S was installed in a New Jersey Central Station. Since then, it has continuously and faithfully crushed more than 6 million tons of coal.

But here is the eye-opening part of this enviable record; during this entire 20-year period, the total parts replacement cost per ton of coal crushed has been only $.00025. (In other words, *40 tons for a penny*).

Even more convincing proof of American Crusher *quality* is the fact that this is a *typical case history*—not an isolated example. An extensive independent survey has revealed over and over again that Americans consistently produce high tonnage for years—at amazingly low parts cost figures. Discover for yourself why Americans are preferred everywhere for performance, for dependability, and for economy of operation.

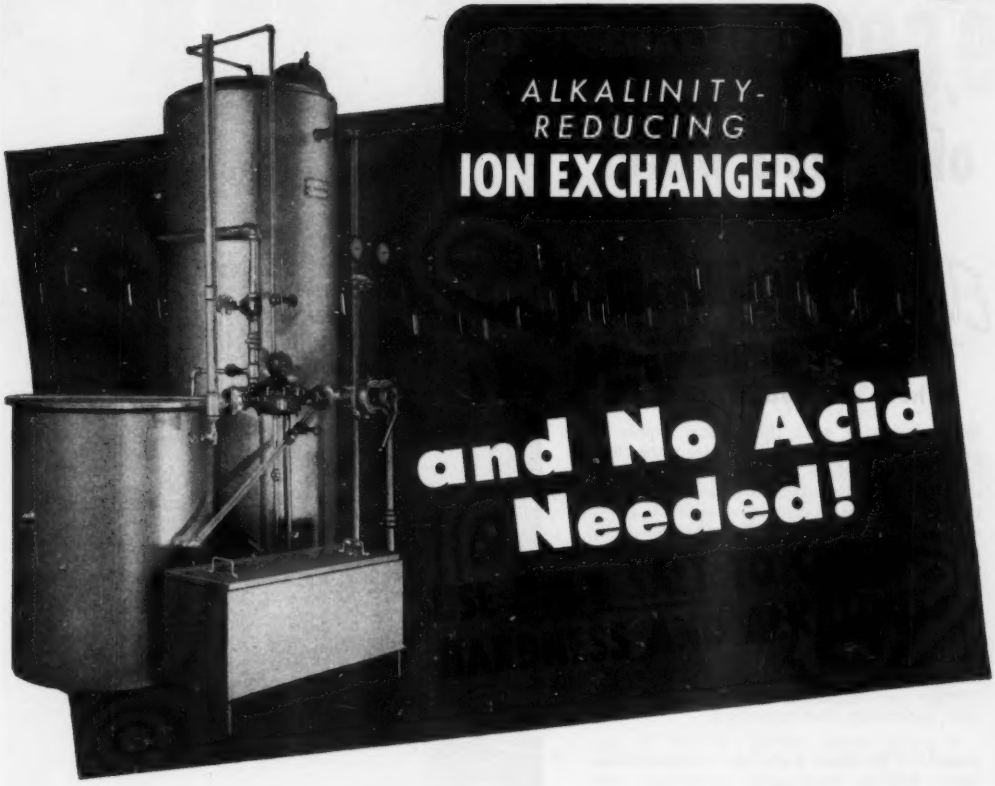
WRITE for special "AC Coal Crushing Bulletin"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

Announcing



ALKALINITY-REDUCING ION EXCHANGERS

and No Acid Needed!

THIS SALT-SPLITTER SYSTEM removes both alkalinity and hardness by means of two resin beds in one tank. Needing only inexpensive salt — no acid — for regeneration, it offers these advantages:

1. Permits operation at alkalinities approaching zero, since no acid is present to damage equipment or produce acid water.
2. Eliminates costly rubber- and lead-lined tanks and piping.
3. Simplifies disposal of spent regenerant.
4. Provides complete safety for operating personnel.

Users of sodium zeolite softeners who find them unsuitable because of the high alkalinity of the effluent or who may be by-passing raw water for boiler make-up should definitely investigate the possibilities of incorporating this system into present installations.

For a concise explanation of the operation of this new combination of two proven water-conditioning methods, get a copy of the new Allis-Chalmers bulletin, 28X7808. Just fill in and mail the coupon.

Allis-Chalmers
Milwaukee 1, Wisconsin

Please send Bulletin 28X7808 describing alkalinity reduction by ion exchange.

Name

Title

Company

Address

City State A-3612

ALLIS-CHALMERS

Water Conditioning

✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE

Lederle pumps 9,000 gallons of cooled water *EVERY MINUTE!*

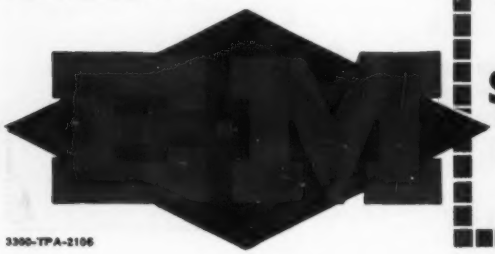
E-M Hi-Fuse Controls help safeguard supply

Seven days a week this critical supply of properly cooled water circulates from the cooling tower at Lederle Laboratories Division of the American Cyanamid Company. Vital in the manufacture of drugs and antibiotics, the water volume is kept steady and constant by E-M Hi-Fuse High-Voltage Controls for the pump motors.

At Lederle, coordinated Hi-Fuse Controls start the motors smoothly and powerfully by the E-M-developed Polarized Field Frequency Relay method . . . simplest, most effective automatic starting system ever designed. Reduced-Voltage starting feature minimizes current inrush, protecting other equipment.

If pump motors should fall out of step, Lederle's Hi-Fuse Controls re-synchronize them. Built-in short-circuit protection with high interrupting capacity fuses clears faults in less than half a cycle before motor or control is harmed. Accident-proof isolation of high voltage parts provides greater safety for operators. You can install E-M Hi-Fuse Control Panels anywhere. They are completely metal-enclosed, sturdy and safe.

Economy is important, too. Lederle's E-M Hi-Fuse Controls are as thoroughly safe and practical as circuit-breaker types of controls costing almost twice as much. Ask your nearest E-M sales engineer about Hi-Fuse possibilities for your own operation, and write the factory for Publication No. 192.



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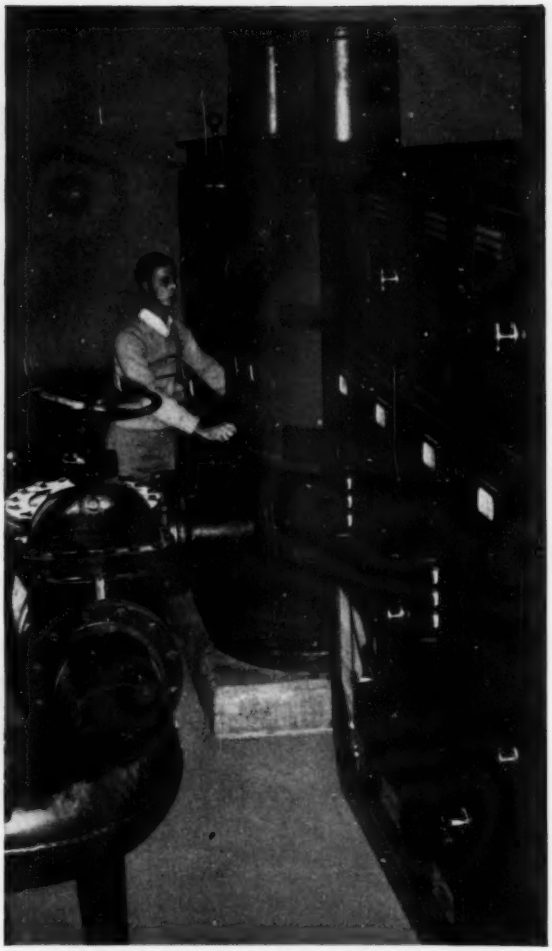


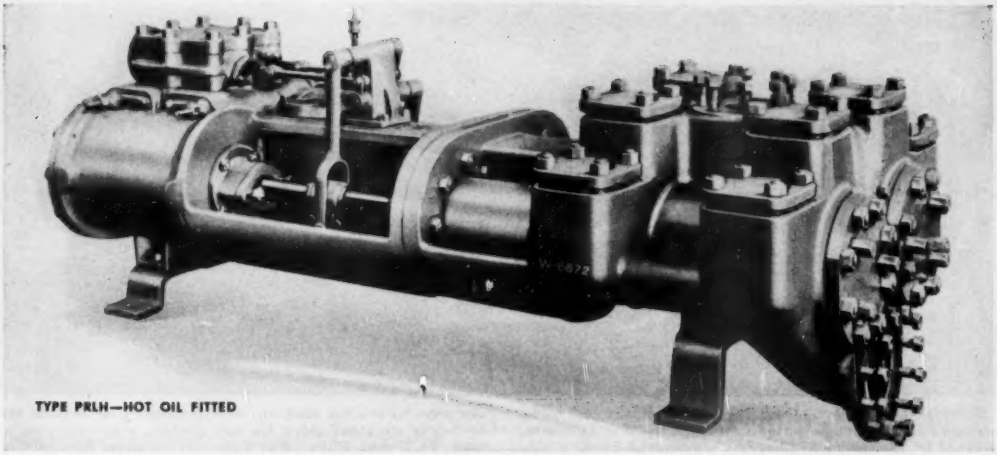
E-M Magnetic Reduced-Voltage Hi-Fuse Controls in cooling tower pump house at Lederle Laboratories Division of American Cyanamid Company, Pearl River, New York. The two 400 hp, 1200 rpm, unity power factor E-M Vertical Hollow-Shaft Synchronous Motors are seen in the background.

Originators of

AUTOMATIC CONTROLS FOR SYNCHRONOUS MOTORS

ELECTRIC MACHINERY MFG. COMPANY

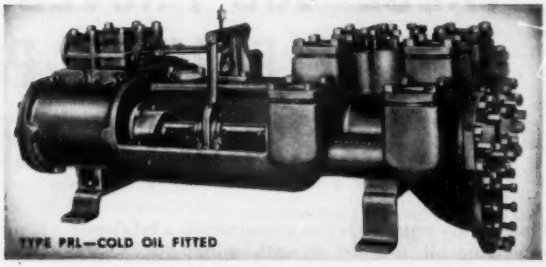
MINNEAPOLIS 13, MINNESOTA



TYPE PRLH—HOT OIL FITTED

We've Built New and Superior Strength into

Worthington Steam Pumps



TYPE PRL—COLD OIL FITTED

NEW STEAM ENDS RATED UP TO 250 PSI

Steam cylinders and flanges designed for 250 psi maximum working pressure hydrostatically tested to 375 psi . . . Drop-forged steel steam valve gear . . . Heavier piston rods . . . ½ in. minimum drain openings allow heavier pipe connections . . . Those are some of the *strength features* built into Worthington's new line of steam pumps.

MORE FEATURES OF ADVANCED DESIGN

Then, for *longer wear*, the steam valve gear is lubricated—oil cups on the rocker arms give longer bearing life.

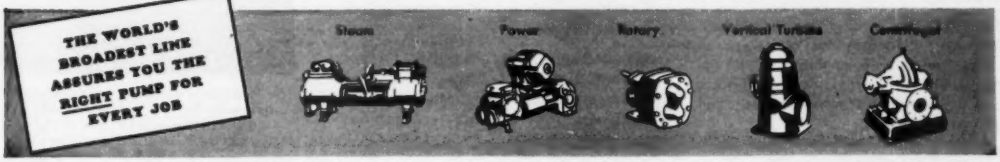
And *accessibility:* two-piece piston rods, either part removable without disturbing the other end . . . flanging on steam cylinder permits easy lagging . . . external cushion valves (on larger sizes).

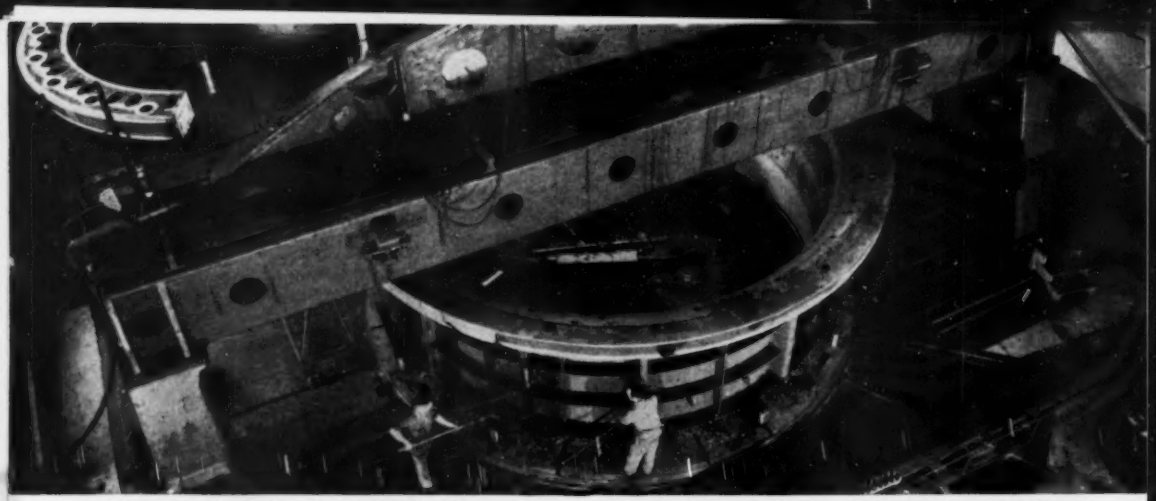
This new line of duplex steam pumps represents Worthington at its best—the broadest range, the finest engineering. It's one more proof that *there's more worth in Worthington.* For information about specific pumps, write Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.

WORTHINGTON

P.1.3

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB





This $400,000 vertical boring mill, one of the world's largest, bores, turns and faces hydraulic turbine parts. Sunoco Way Lubricant, approved by 38 machine tool builders, was selected by the design engineers to prevent stick-slip with resultant poor finishes and scoring of ways and slides. On this machine, even with work as heavy as 75 tons, Sunoco Way Lubricant has never squeezed out.

THESE "JOB PROVED" SUN PRODUCTS HELP BOOST PRODUCTION AND REDUCE OPERATING COSTS

When a Sun representative recommends a lubricant or cutting oil, he does so with confidence. Every product developed in Sun's laboratories is exhaustively tested by actual use in industry until desired performance characteristics have been clearly established. Only then is it rated "Job Proved" and offered for sale.

In tackling your problems, a Sun representative draws on the wealth of experience he has acquired working in all fields of industry. If the technical nature of your problem calls for it, one of a special group of Sun mechanical and chemical engineers will go to work in your behalf. Back of them, remember, are the vast research, development and refining facilities of Sun Oil Company. All this is your assurance that Sun products will help you boost production and reduce operating costs.

Full information about Sun oils and greases or the services of a Sun representative are yours for the asking. Just call or write the nearest Sun Office.

GENERAL LUBRICANTS

SUNVIS 900 OILS. Unexcelled for turbine lubrication, as a hydraulic medium, for circulating systems, and for similar applications requiring longest possible oil life, plus maximum protection to equipment. Sunvis 900 Oils have a high viscosity index and uniform 0°F pour point, and are fortified against corrosion and oxidation.

SUNVIS OILS. Give long, trouble-free service in all types of industrial reservoirs and circulating systems operating at normal temperatures. Sunvis Oils have uniform high viscosity index, low pour point, and low carbon content.

SUNVIS H.D. 700 OILS. For internal combustion engines operating under heavy-duty conditions, or where hydraulic valve-lifters are used; for circulating systems and other industrial applications where contamination is a factor. Sunvis H.D. 700 Oils supply detergency, and minimize oxidation and corrosion.

DYNAVIS OILS. For internal combustion engines operating at moderate loads and speeds. These low-pour-point, high-viscosity-index, inhibited oils help prevent formation of harmful corrosive and sludge-forming acids.

CIRCO OILS. Straight mineral oils for general lubrication of industrial machinery. Unsurpassed for once-through applications, regardless of operating temperatures.

SOLNUS OILS. Approved by many manufacturers for air compressors, vacuum

Now 95 bottles a minute can be processed continuously by this washer, thanks to a Sun Adhesive Pressure Grease. In the past, shutdowns were required after short intervals because the lubricant then in use did not adhere, leading to open gear failures.

pumps, low-speed diesels, and general lubrication where a high-quality straight mineral oil is needed.

SUNEP OIL. Lead-naphthenate type of lubricant for heavy-duty gears and other applications. Great stability, plus rust preventive and non-corrosive characteristics, helps prolong life of gear sets.

SUNTAC OILS. Recommended for general lubrication of all machines where dripping and splash should be held to a minimum. Compounded to increase adhesiveness, Suntac Oils cling to bearing surfaces and supply constant, superior lubrication.

STEAM CYLINDER OILS. Lubricants of high flash and fire point for saturated or superheated steam conditions and for worm gear speed-reduction units.

SUNOCO WAY LUBRICANT. Eliminates "stick-slip" of tables and scoring of machine tool ways. Noncorrosive, with outstanding metalwetting and adhesive properties, ample viscosity and E.P. qualities. Approved by 38 leading machine tool manufacturers.

ROCK DRILL OIL. High-film-strength oil for use in jackhammers, stopers, drifters and similar equipment.

INDUSTRIAL GREASES

SUN GUN GREASES. Smooth greases with excellent pumpability characteristics. Designed for pressure fittings on equipment operating at normal speeds and temperatures.

SUN ADHESIVE PRESSURE GREASES. Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES. For power-driven central grease lubricating systems in heavy industries. Also used as "medium cup greases."

SUN MINE CAR GREASES. Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity type wheels.

SUN MINING MACHINE LUBRICANT. Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

SUN ROLLER BEARING GREASES. For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS. Black adhesive open-gear compounds and wire-cable greases. Recommended for power presses, mining machinery, worn reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND. For crawler type tractors. Provides good lubrication with exceptional sealing qualities.

METALWORKING OILS

SUNICUT. Straight (non-emulsifiable) transparent cutting oils. Various grades for automatic screw machines and heavy-duty machining operations. Permit high-speed production with excellent finishes, long tool life.

SUNOCO EMULSIFYING CUTTING OIL. An emulsifiable oil which produces a stable white emulsion when mixed with water. Efficient and economical cooling and lubricating medium for turning, milling, drilling and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant. Available in heavy-duty grades also.

SUN QUENCHING OILS. Specially refined oils designed to aid development of maximum desired physical properties in a wide variety of steels.

SUN TEMPERING OILS. Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.

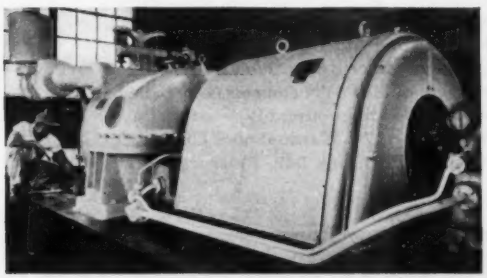
SUN ROLLING OILS. Straight and emulsifying oils which permit maximum production in rolling steel, aluminum, brass and copper.

REFRIGERATION OILS

SUNISO REFRIGERATION OILS. High-quality oils with extremely low pour points, extremely low wax-separating characteristics, great stability, and long life. Initially neutral and resistant to formation of detrimental acids. Suniso grades are available to meet all low, normal and high temperature conditions. The most widely used oils in refrigerating and air-conditioning.

ADDITIONAL INDUSTRIAL PRODUCTS

SUN SOLVENTS. Sun Spirits for the thinning of paints, varnishes and enamels, for metal-cleaning, and for certain types of processing and extraction . . . a pure, water-white petroleum solvent, free of corrosive sulfur. Other Sun solvents with special properties are available for the chemical industry.



This turbine supplies most of Nantucket Island's power during summer peak loads. In winter it is idle, but journals, bearings and controls always remain free of sludge, rust and corrosion—because Sunvis 916 protects them. Its metalwetting characteristics prevent any moisture present from displacing the oil.

Gates, valves and capstans—the entire mechanism of this new Monongahela River lock—operate hydraulically. The engineers in charge chose Sun Hydraulic Oil over all others because they felt it could be best counted on to keep the lock in operation and river traffic moving despite extremely rigorous conditions.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO®

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

..with the type ASR Synchronizing Relay

Getting the motor started right every time—and providing complete protection at all times—are the basic functions of the new Westinghouse SLIPSYN Synchronous Motor Control.

Heart of the new SLIPSYN is the amazing Type ASR synchronizing relay. Characterized by its extremely simple, sturdy and reliable design, this new relay is especially suited for heavy industrial service.

The ASR not only applies the field at the proper speed, but also at a favorable rotor position for best synchronizing performance. It is easily adjusted on the job for best operating conditions under actual load.

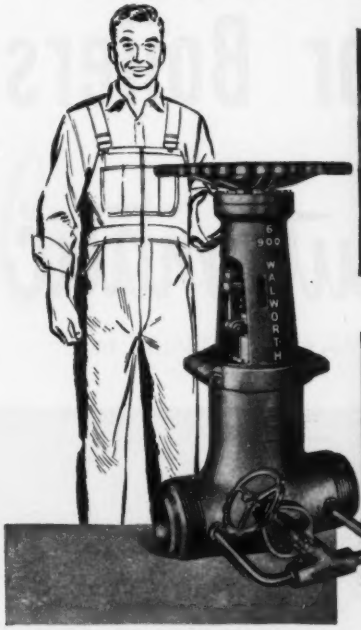
**Trade Mark*

SLIPSYN is the name applied to the complete line of Westinghouse Synchronous Motor Control. Standard types are available for operating and protecting all types of synchronous motor drives. Find out all the advantages of SLIPSYN controls now. Call your nearest Westinghouse office or write for Booklet B-4379. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-21588

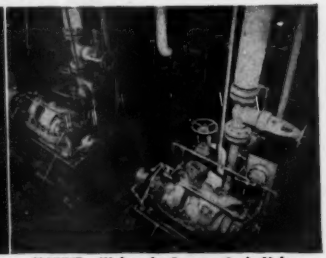
WALWORTH Pressure-Seal VALVES

For high-pressure, high-temperature services

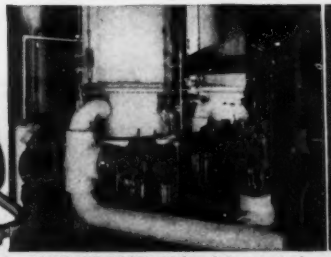


Walworth 6-inch Series 900 Pressure-Seal Gate Valve with Series 1500 Y-type Globe Valve on the by-pass.

CHEMICAL PLANT: Walworth Pressure-Seal Valves in the pressure reducing station of a chemical plant.



MARINE: Walworth Pressure-Seal Valves aboard the S.S. "Wilfred Sykes"—largest Great Lakes ore carrier.



LIGHT AND POWER: Walworth Pressure-Seal Valves equipped with motor operators, in an eastern public utility plant.

PAPER MILL: Fabricated header with 8-inch Series 600 Pressure-Seal Y-Globe Non-Return Valves and Series 600 Pressure-Seal Gate Valve.

SMALL VALVES FOR HIGH PRESSURE-TEMPERATURE SERVICE

Series 1500 Cast Steel Y-type Globe and Angle Valves in sizes ¼ to 2 inches.

The bonnet and body design of Walworth Pressure-Seal Valves is such that the pressure within the valve is used to prevent leakage at the junction of the bonnet and body. The bonnet joint of the Walworth Pressure-Seal Valve is permanently tight because there is no dependency on the ability of any component part of the joint to resist creep during long exposure to high temperature. Sudden temperature and pressure changes do not affect this tightness. Bonnet flanges and studs are eliminated and the weight of the valve is reduced.

An improved flexible disc design maintains seat tightness, even when the valve body is distorted by pipeline stresses or by temperature and pressure changes. This improved disc design makes it easier to open and close this valve.

Walworth Pressure-Seal Valves are easy to disassemble and assemble, and are the most satisfactory valves for high-pressure, high-temperature service. They are available in Series 600, 900, 1500, 2500 and in a wide range of sizes and types. For further information, write for Circular 116.

WALWORTH

valves • fittings • pipe wrenches

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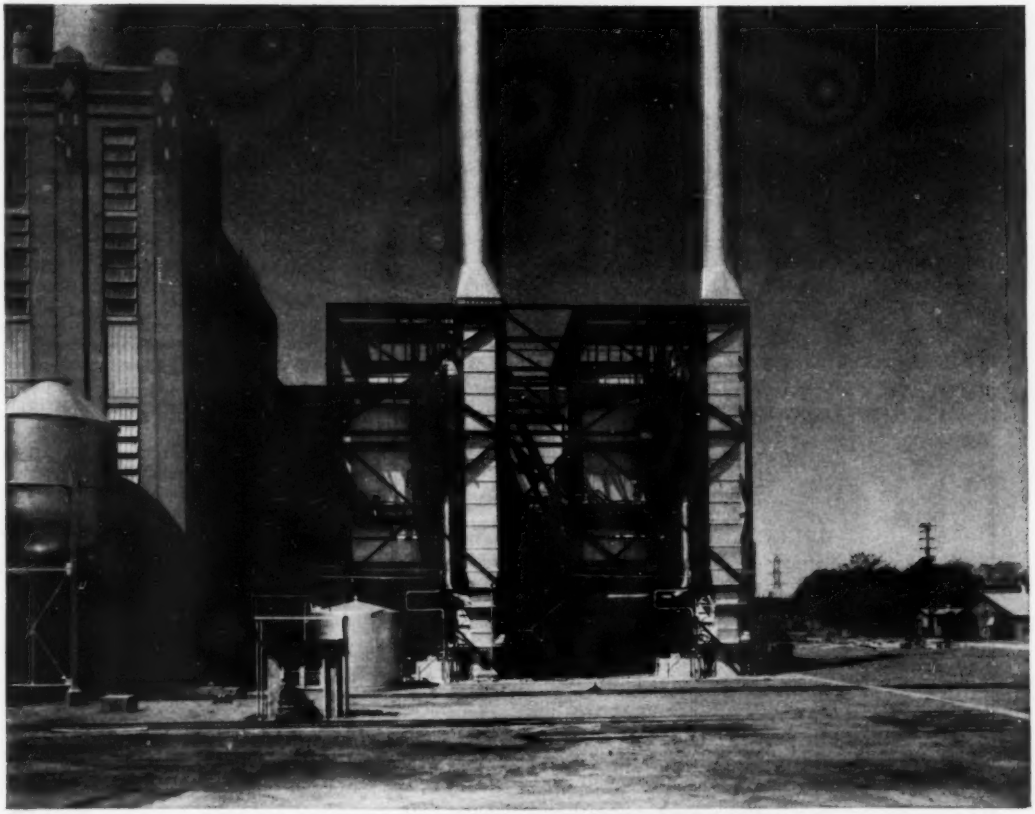
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Two Outdoor Boilers Under Automatic



Outdoor Installation of Two Large Boilers at the Trinidad Steam Electric Station.

Aerial View of Trinidad Steam Electric Station. (Note the Two Outdoor Boilers Installed Behind the Main Building).

Control

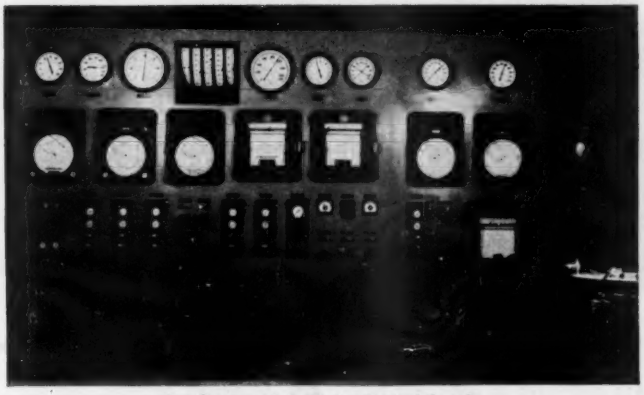
at TRINIDAD STEAM ELECTRIC STATION • Texas Power & Light Company

● A most important part of the Texas Power and Light Company expansion program at their Trinidad Steam Electric Station, is this outdoor installation of two new gas fired, 350,000 lb. per hr. boilers. These boilers, operating at 920 psig., provide 70,000 KW additional capacity to meet the increasing power demand on the Trinidad Station. To achieve maximum efficiency and performance, the boilers were put under completely automatic control.

The AUTOMATIC COMBUSTION CONTROL system and the PRESSURE REDUCING AND DESUPERHEATING STATION were supplied by REPUBLIC FLOW METERS CO.

A Potent Tool for Cutting Costs

A properly engineered automatic control system is an effective way to cut power costs. Best of all, what automatic control is doing for the large plants such as the Trinidad Steam Electric Station it is also doing for their smaller brothers. But the full benefits can only be realized if the plant designer selects with great care the best control equipment for his job. The control must be carefully matched to the boiler and auxiliary equipment characteristics; it must maintain maximum combustion efficiency under all load conditions.



One Section of the Boiler Control Panels.

REPUBLIC CONTROLS are available for all types of load fluctuations, fuel firing, single or multiple fuels, and all types of boilers and auxiliary equipment. Backed by thirty-six years of specialized experience in combustion control, REPUBLIC'S power engineers have developed control systems to answer every type of steam generating problem.

Ruggedly built to outlast the boilers that they serve, REPUBLIC AUTOMATIC CONTROL gives you the best, most economical system engineered to suit your needs.

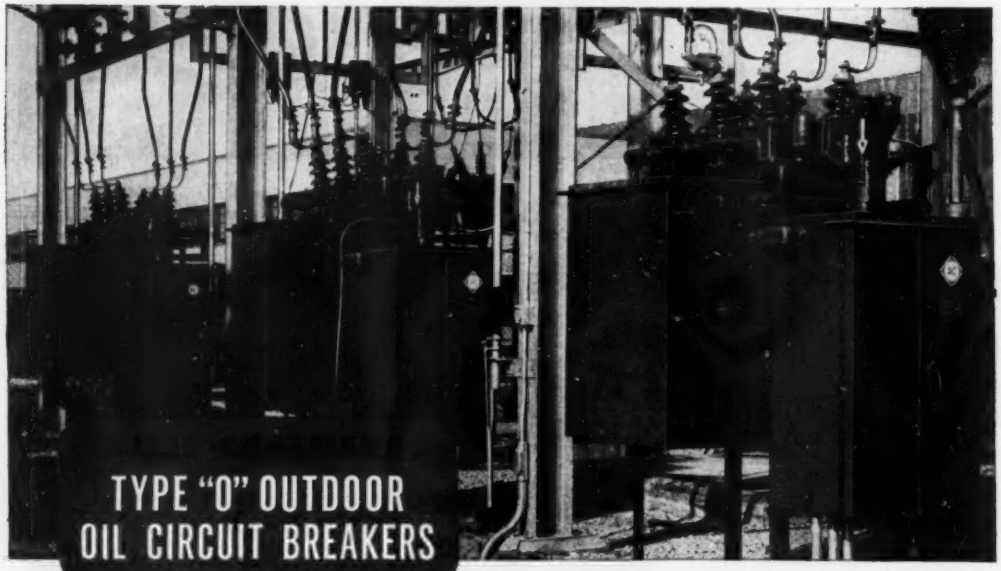
For more information on REPUBLIC AUTOMATIC CONTROL write for Data Book No. S-21 or contact our field engineer nearest you.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

Dependable

ELECTRICAL PROTECTION

FOR DISTRIBUTION SYSTEMS



Packaged complete for improved automatic reclosing service

ALL YOU NEED to order your type "O" breaker is one set of specifications. It's simple and convenient. This standard 3-pole breaker comes to you mounted on a strong lightweight framework with operating mechanism and automatic reclosing equipment each in its own weatherproof housing. The type "O" breaker is factory assembled, wired and tested in accordance with ASA standards . . . ready to install and operate.

SECURE THESE PROVEN ADVANTAGES

1. **Positive, high speed breaker action with mechanically and electrically trip-free solenoid operating mechanism, ac or dc operation as specified.**
2. **Efficient circuit interruption with high rate of dielectric recovery for low contact and oil deterioration.**
3. **Automatic reclosing duty for unattended stations with standard protective and reclosing relay equipment included.**

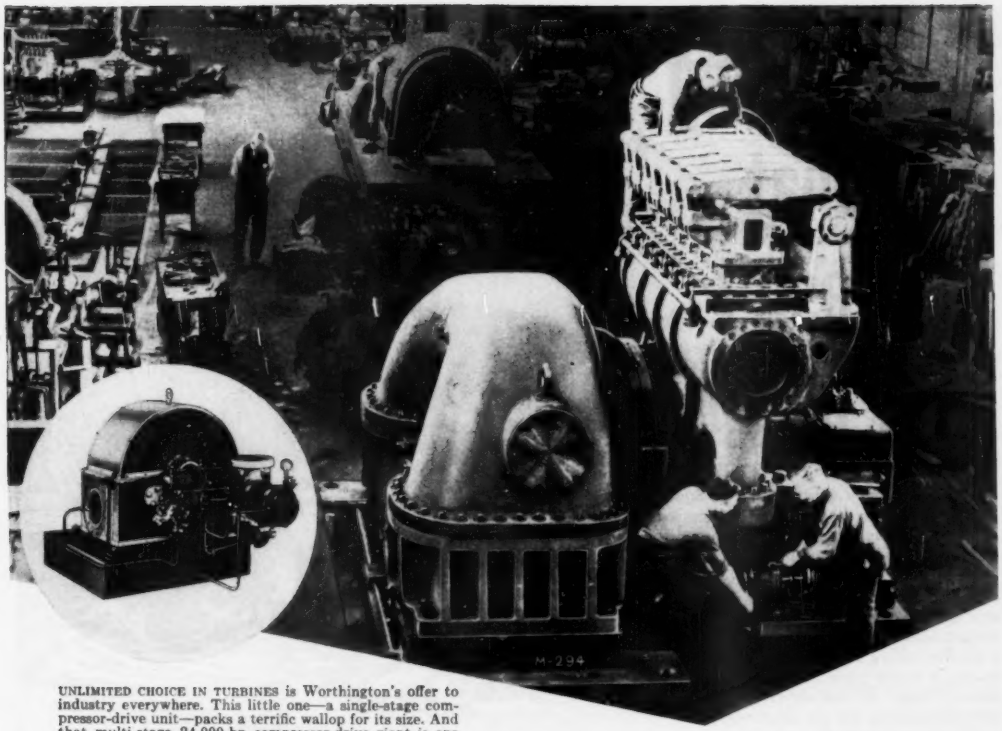
Feature for feature you cannot buy better breakers in this class. Over 50 years of Allis-Chalmers progress in power circuit breakers is built into them. You can install them with complete confidence. For more information call your local A-C sales office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletins 71B6165A (OX-18) or 71B6093C (OZ-110, OZ-210).

A-3440

Type	Rated KV	Rated Amps. (60 cycle)	Interrupting Capacity KVA
OX-18	7.2	600	50,000
OZ-110	14.4	600	100,000
OZ-210	14.4	600	250,000
OZ-210	14.4	1200	250,000
OZ-210	23	600	250,000

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



UNLIMITED CHOICE IN TURBINES is Worthington's offer to industry everywhere. This little one—a single-stage compressor-drive unit—packs a terrific wallop for its size. And that multi-stage 24,000-hp compressor-drive giant is one of the largest ever built for this type of service.

Single-stage midgets to multi-stage giants

Whether your turbine requirements call for the biggest or the smallest—straight condensing . . . straight non-condensing . . . extraction . . . mixed pressure extraction . . . low pressure . . . high back pressure . . . for mechanical or generator drive . . . with governors for constant or variable speed—*Worthington has an answer.*

Each Worthington turbine is designed to make the steam do *more* work, so you save power and money throughout its long life.

Learn more about Worthington turbines. Get the facts on why *there's more worth in Worthington* by writing to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.

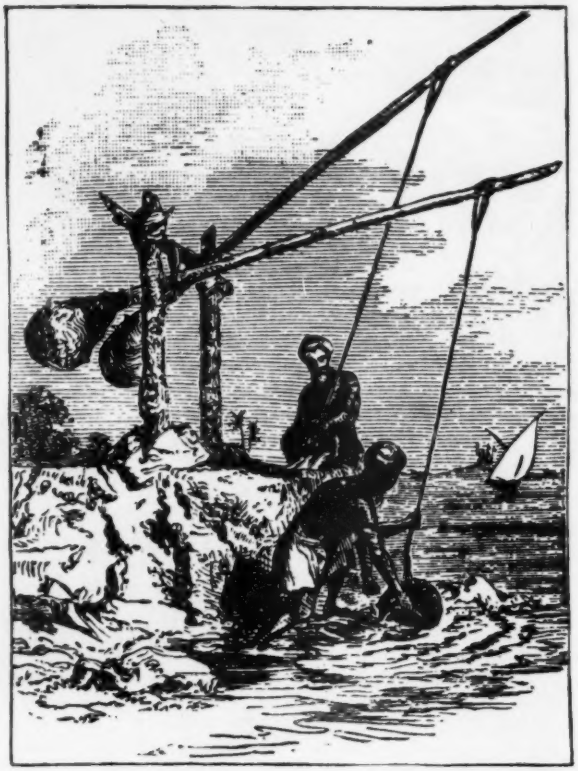
T.2.2

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbines

The Pump that wasn't a pump



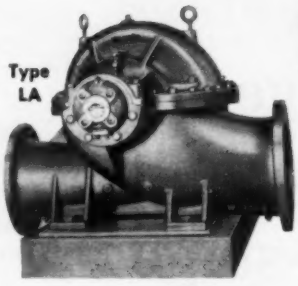
For many years this peculiar looking contrivance was the most efficient means known for moving water from one level to another—but it wasn't really a pump, it was a "shadoof".

Though still used today in many parts of the world, this hand-operated "bailing lever" is said to have been used 3000 years ago by the ancient Babylonians. On the basis of six strokes a minute, with a bucket that held 60 pounds of water, it could raise 36 gallons per minute. Those "bags" on the short end are used as counterpoises to lift the filled vessels.

If this were 3000 BC and you were looking for a pump for *any* purpose, the best Worthington could do for you would be to recommend a shadoof. The drive? Only *one* available—a husky slave.

Almost fantastic, isn't it, that crude devices like the shadoof, the mechanical innovations of their day, were the starting points for modern Worthington pumps—centrifugal pumps that can move as much as 250,000 gallons per minute; individual designs with 100,000 standard combinations of capacities, heads, casings, and mountings for *any* drive available; single-stage, multi-stage, volute, turbine, horizontal, vertical, Mixflo, Axiflo and regenerative pumps—for virtually every need of utilities, petroleum, paper, sugar, food, chemical, marine, water works, metal-working, and many other industries.

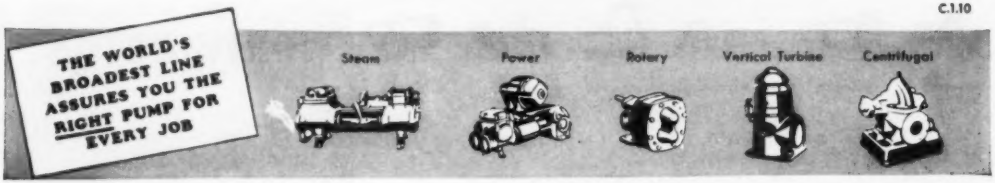
Yes, there's a Worthington pump for your requirement—a pump that's *standard* with Worthington. To find out about it, consult your nearest Worthington District Office or write to Worthington Pump and Machinery Corp., Centrifugal Pump Div., Harrison, N. J.



When you buy Worthington centrifugal pumps — the most complete line you'll ever find—you'll always be assured of the *right* pump for every job. Typical of this broad Worthington line is this large LA (to 60,000 gpm) at left; monobloc DN pump (to 2500 gpm), center; and the CN, frame-mounted version of the DN, in over 10,000 combinations.

WORTHINGTON

C.1.10



How can we stop heavy scaling in our condenser for process vapor?

HALL LABS

FACTS: Working closely with plant personnel, the Hall Engineers found:

Equipment—barometric condenser pulling slight vacuum on "cooking" vats in which organic material was processed.

Temperature—"cooking" operation close to 200°F.

Water—city water had caused no trouble, but switch to well water resulted in serious deposition of scale. Well water very hard—860 ppm—and high in bicarbonate.

Scale—chiefly calcium carbonate.

Trouble—difficult to control vacuum; shut-downs for cleaning costly, interfered with production.

SOLUTION: Threshold treatment, with a few ppm of glassy phosphate, *at low cost*, stopped scaling.

REMEMBER: Whatever your problems with water for power, cooling, process or disposal, let Hall Laboratories' quarter-century of research and engineering experience help you solve them. Write, wire or call Hall Labs today.

HALL LABORATORIES, INC.

Hagan Building, Pittsburgh 30, Pa.

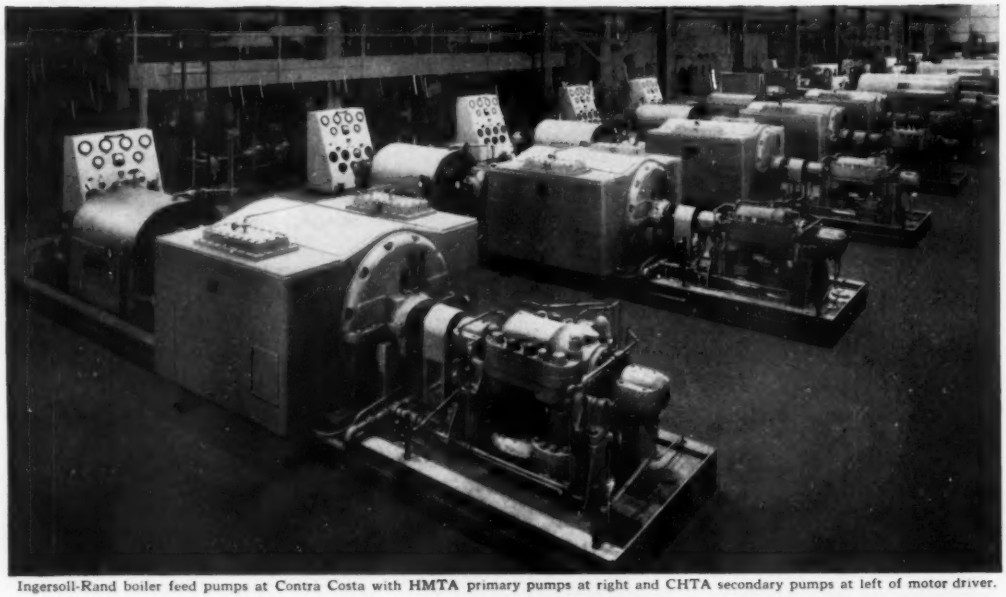
(A Subsidiary of Hagan Corporation)

Consultants on Procurement, Treatment, Usage and Disposal of Industrial Water

Hall Plant Wide Water Service

I-R PUMPS SERVE CONTRA COSTA

Pacific Gas and Electric Company's newest generating station uses Ingersoll-Rand's new Class HMTA boiler feed pumps

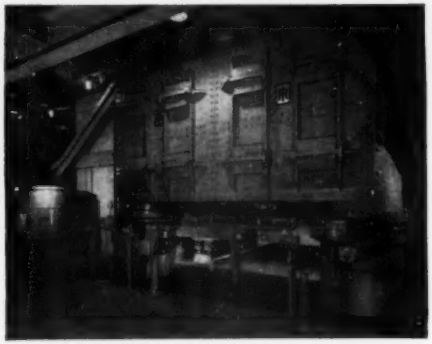


Ingersoll-Rand boiler feed pumps at Contra Costa with HMTA primary pumps at right and CHTA secondary pumps at left of motor driver.

The Pacific Gas and Electric Company's new and ultra-modern steam plant at Antioch, California will make available 300,000 kw to help meet the high system load of the productive Contra Costa county area. This modern boiler feed pump installation – incorporating both the new HMTA and the popular CHTA pumps – is designed to establish new standards of high pressure pumping economy.

The Contra Costa Station uses the two-pump feedwater system – each pump set carrying half the load of a 100,000 kw generating unit. The six-inch, 3-stage HMTA primary pumps, which handle 228° water at 24 psi, discharge to the low pressure heaters at 574 psi. The five-inch, 8-stage CHTA "double case" secondary pumps take 430° water at 520 psi and deliver 1310 gpm at 1990 psi. Tandem mounting permits centralized lubrication and low temperature injection from primary pump to stuffing boxes of secondary unit, which means longer packing life.

Ingersoll-Rand Class HMTA multi-stage centrifugal pumps, with advanced design and a Unit-Type rotor assembly, are available in capacities to 1600 gpm and pressures to 1200 psi. Your nearest I-R representative will be glad to give you complete information.



CONDENSERS AND AUXILIARIES ARE I-R TOO

Three, 50,000 sq. ft. I-R rectangular condensers are supplied with almost 270,000 gallons of cooling water per minute by six, 36" Class APM pumps. Condensate from the units is handled by six, 16" Class APHC, four-stage vertical pumps.

Ingersoll-Rand

Cameron Pump Division, 718-10
11 Broadway, New York 4, N. Y.

PUMPS • COMPRESSORS • CONDENSERS • ROCK DRILLS • AIR AND ELECTRIC TOOLS • DIESEL AND GAS ENGINES • VACUUM EQUIPMENT

BATTLESHIP CONSTRUCTION
Built above and beyond the demands of average service. Photo shows fan with section of housing removed.

These HEAVY-DUTY FANS

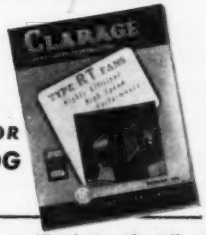
Now Operating in 43 States and 15 Foreign Countries

Wide popularity — and deserved! Clarage Type RT Fans bring efficient performance and tremendous endurance to your **most exacting** jobs — induced draft, forced draft, and furnishing air for industrial processes . . . pressures to 38.6 inches (standard air); temperatures to 1000 deg. F.; capacities to 300,000 c. f. m.

Here is **HEAVY-DUTY fan equipment** which carries the endorsement of consulting engineers, plant engineers and boiler manufacturers. Install RT Fans and your first cost is the last — for a **long time** to come. Call us in for specific recommendations!

YOU CAN RELY ON

CLARAGE



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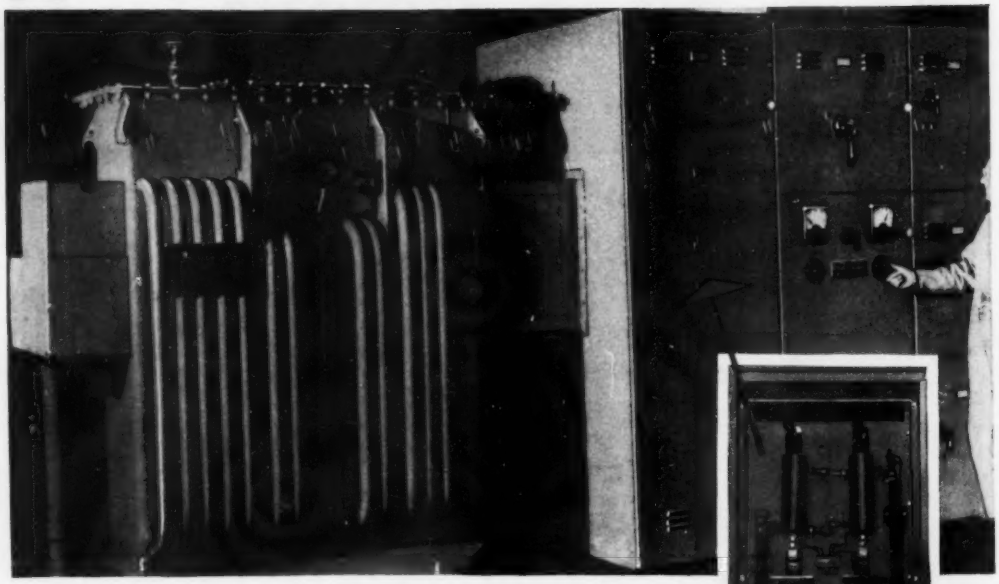
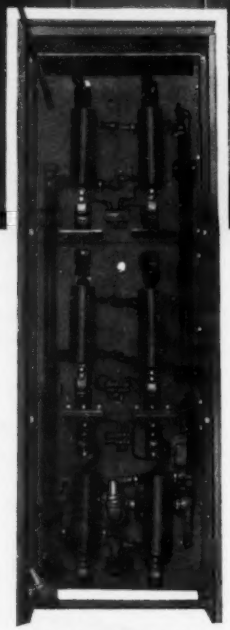
IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Now, St. Paul Foundry & Mfg. Co. buys all its power; saves $25,000 annually!





Costly, Inefficient Steam Generating Plant Replaced by

D-C UNIT SUBSTATION

Boiler capacity for cold weather heating is all that the St. Paul (Minn.) Foundry and Mfg. Co. retains of its former steam-driven d-c generating plant. By using purchased power, the company saves $25,000 annually in fuel, operating, and maintenance costs.

Purchased power is a-c, but the plant requires d-c power for yard cranes and hoists. To tie these two systems together, a six-tube G-E sealed ignitron rectifier was installed. It operates 24 hours a day, 7 days a week.

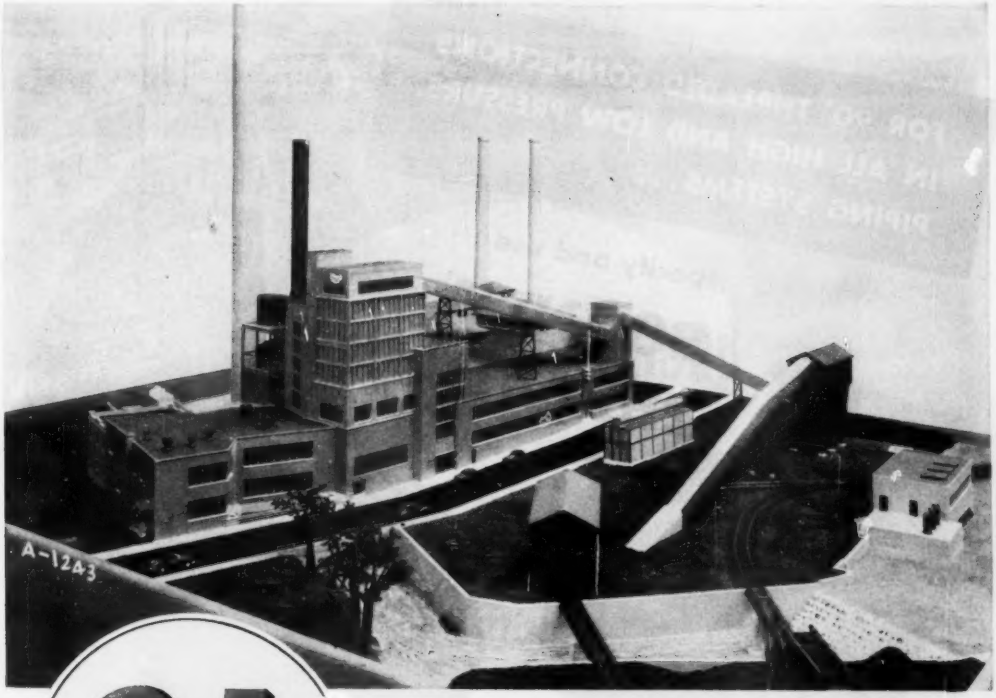
General Electric d-c unit substations with modern sealed ignitron rectifiers occupy minimum space. The transformer, rectifier and low-voltage switchgear are supplied as a complete, metal-enclosed, packaged unit. Absence of exposed, energized parts provides maximum protection to personnel. For information on d-c unit substations to fit your d-c power needs, call or write your nearest G-E sales office. General Electric Company, Schenectady 5, N. Y.

This photo shows the simple, compact design of the G-E ignitron mercury-arc rectifier unit.

No major moving parts to wear out.
No bearings or brushes to check.
No vacuum pump required.

GENERAL ELECTRIC

324-4



At the Webster Street Station of the Worcester County (Mass.) Electric Co., a system of S-A Belt Conveyors performs the complex coal handling duties. S-A engineering experience helped overcome difficult conditions to provide efficient coal handling with maximum economy.

S-A CONVEYING Systems for Coal Handling and DISTRIBUTION

In power plant installations of all sizes, S-A engineers have met requirements which go far beyond *conveying* coal from gondolas to boilers.

These conveyor installations are in the fullest sense distribution systems—frequently automatic and under push-button control. They provide for optional flow at many points—to bunkers or stock-pile—to old boiler house or new—to weigh station, breaker or transfer house—to and from storage in silos or outdoor stockpiles. Great versatility is demanded.

S-A is impressively equipped to meet ever-new demands. Not only experienced engineers but the most complete line of equipment assures you an unbiased recommendation. Write us for full details.

Belt Conveyors
Belt Trippers
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll & Ring Type
Bucket Elevators
Gravity Discharge Conveyors
Pivoted Bucket Carriers
Flight & Chain Conveyors
"Natural Frequency" Vibrating Conveyors
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Pan Conveyors
Track Hoppers & Bin Gates
Conveyor Belt Cleaners
Headshaft Holdbacks
Speed Reducers & Bearings
Car Pullers & Spotters
TELLEVEL Bin Level Controls
Hoists & Winches
Centrifugal Pilers
Water Intake Screens

Write for a bulletin on any of the above

STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

FOR 90° THREADED CONNECTIONS IN ALL HIGH AND LOW PRESSURE PIPING SYSTEMS . . .

specify and use

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YOU DERIVE THE FOLLOWING ADVANTAGES:

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Power
COMBINED WITH OPERATING ENGINEER

Good Times Ahead

POWER is an engineering magazine—not a journal of economic trends or business reports. Just the same, every power engineer has a very personal interest in learning whether business prospects are good or bad. So let's look ahead a bit, with the help of the McGraw-Hill Department of Economics.

According to the Department's *Fifth Annual Survey*, just completed, American industry, in 1952, will lay out 13 percent more money than ever before in history for capital goods—mostly new and modernized equipment and buildings. Even when the present defense boom tapers a little next year, business spending will keep rolling at a level well above pre-Korea. There are no storm warnings to suggest any drying up of capital investment, such as happened in the 1930's.

Preliminary plans for all industry (manufacturing, mining, transportation and utilities) already call for spending 16.7 billion dollars in 1953, 15.1 billion in 1954, and 14.1 billion in 1955.

Allowing for the fact that distant future plans are always incomplete, industry's investment rate will be well above pre-Korea, although perhaps 20% down from the colossal defense-boom levels of 1952.

Comparing 1952 with 1951, money spent by manufacturing industries alone to build new plants and replace obsolete equipment will jump from 11.1 billion to 12.9. That's a 16% average increase, but some industries will do far better.

For example, the electrical manufacturers will more than double their 1951 investment rate. If you count both private electric utilities and public power agencies, 3.8 billion dollars will be spent for electrical power systems in 1952. This exceeds even petroleum and coal products by forty percent, and is miles ahead of all other industries.

It's interesting to see what the two defense boom years —1951 and 1952, taken as a unit—are adding to America's productive capacity. For these two years the gain will be 16% for the manufacturing industry as a whole. Electric manufacturing capacity will be up 25%, electric power capacity up 20%.

The electric utility group looks like a sure bet for the long pull, according to the McGraw-Hill survey. Peak expenditures for generating equipment will come in 1953. But companies will carry on for another year at least with continued high expenditures for transmission and distribution equipment.

Perhaps one of the most significant findings of the survey is that most manufacturing companies plan capital expenditures several years in advance. More than 60% of the companies covered by the survey use advance planning. Also all electric utilities budget ahead. All in all, industry now does a great deal more long-range planning than it used to, and much more than people have suspected.

From time to time, for many years, we have recommended power enginering as a solid career for progressive men with the right kind and amount of mechanical and electrical know-how. There is no sign on the horizon to suggest that we should change our tune. American industry keeps getting bigger and bigger. That means using more and more power services. It means also that the quality and dependability of these services is a matter of increasing concern.

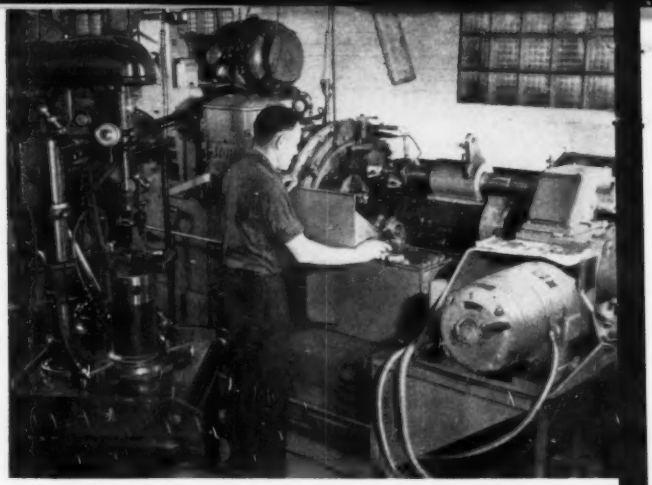
And it necessarily means greater recognition for those engineers who can do a masterful job of power-service generation, transmission and application.

valve values
PHOTO NEWS

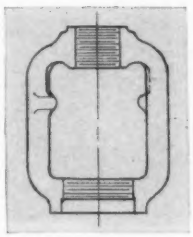
Edward Builds Valve Performance

THROUGH EXCLUSIVE SHOP PROCESSING

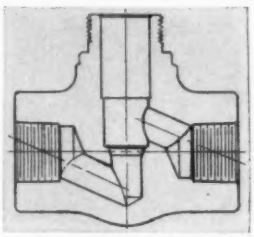
Today's turbines, boilers, refinery cracking units, and chemical apparatus are major equipment items that operate continuously for long periods with great reliability. Poorly made valves can cause expensive shutdowns of large investments. Edward's know-how in building steel valves dates from 1904. Costly special machinery in the Edward plant is designed to make valve parts which insure long, trouble-free service. Illustrated are two machines, exclusive with Edward, designed to process strong, drop forged parts with perfect alignment and concentricity, plus fine finishes and tolerances. Add top-notch shop men—then Edward users get the best in plus-value valves.



A unique and exclusive Edward machine tool, combining the best features of Baird, Goss-DeLeeuw, and Edward designs, makes small valve bodies with perfect alignment and finish in one operation. Rockwell-Delta drill presses (left) finish parts for immediate final inspection.

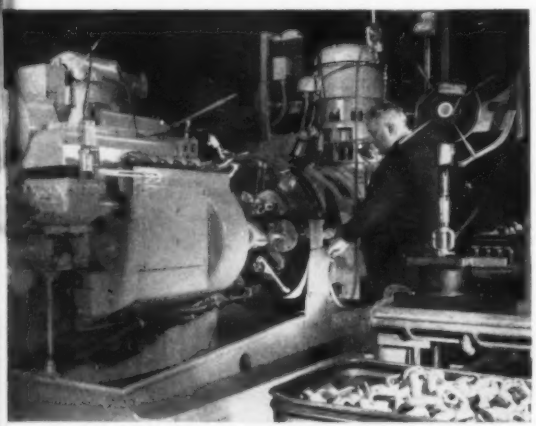


YOKE



BODY

The valve yoke and body *above* look simple, but require the high priced tools illustrated. Every part must be in perfect alignment. By doing the machine operations on such parts in one set-up, valves will go together just right. On the yoke (*left*) both threads are made in one operation. All bonnet-end operations of the drop forged valve body are finished in one set-up.



Exclusive tooling on this "work-rotating chucker" finishes both ends of forged valve yokes simultaneously. One machining operation does the entire job, insuring precision alignment of valve yoke bushings, stems, disks, packing glands, and backseats.

Special gages check alignment of Edward Fig. 952 yoke immediately after making.

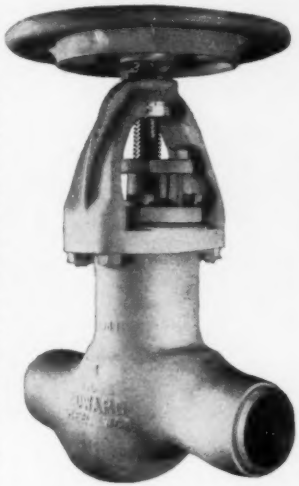
The finished valve parts go together perfectly.

Edward Valves, Inc.

Another Rockwell Product

New Edward *PRESSURE-SEAL** Bonnet Construction

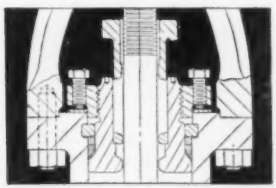
The successful use of pressure seal bonnet valves during recent years has brought to light some problems in the design in smaller sizes. The valve designer, faced with fitting into the bonnet bore a stem, bonnet, pressure sealing gasket, spacer ring, retainer ring, packing chamber, and gasket loading mechanism, found some sacrifices would have to be made unless cost and valve dimensions could be ignored.



The first solution consisted of a large lugged nut gasket pull-up, screwed on to the bonnet and bearing on the top of the yoke base or the retainer ring, so that turning the nut pulled the bonnet upward and deformed the gasket.

This construction (never used by Edward) was found difficult to use in the field. The large diameter threading on the lugged nut, together with the broad bearing surface of the nut, made it difficult to accurately determine the load being applied to the gasket even under favorable conditions. Further, because of moisture in the packing chamber area, the loading mechanism threads frequently corroded badly, making adjustment difficult and service performance more in doubt.

In the smaller sizes, internal pressure provides only part of the load required for gasket deformation. Consequently, positive mechanical loading is even more important than in large valves. Believing that uniform and accurate loading of the gasket is vital to satisfactory performance of all pressure sealed bonnet valves, Edward has provided additional space in 5 in. and smaller *PRESSURE-SEAL** valves by using a yoke outside the normal position.



An exclusive Edward design

Illustrated is a 4 in. 900 lb Edward *PRESSURE-SEAL** globe valve so constructed. Note this permits the use of four small readily accessible, individually loaded studs resting on a hardened bearing plate on top of the valve body. Torque may be applied accurately to each of the four pull-up studs, and the gasket loading uniformly distributed around the gasket contact area circumference. See cross-section view. All Edward *PRESSURE-SEAL** valves have high gasket loading with low individual torque load on the pull-up studs. In addition, they have exclusive features such as scientifically streamlined bodies, integral Stellited seats, and Impactor handwheels as standard construction.

*TRADE MARK REG.

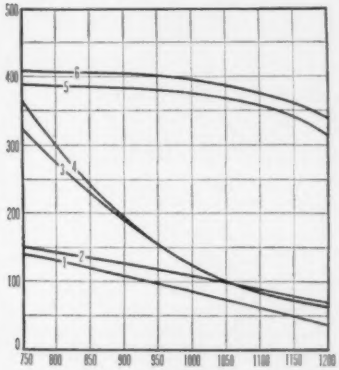
EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
1220 W. 144th ST., EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

Technical Tips

What Heat Does to Valve Trim Hardness

Valve "trim" refers to working parts such as seats, disks and wedges, in contact with line fluid. Hardness, usually expressed as "Brinell" or "Rockwell" is an important requirement in temperature and erosion services. Ability to retain room temperature hardness largely determines valve trim life in many services above 800 F. Chart below shows what continued heating does to hardness of several trim alloys. Base line hardnesses at 750 F approximates room temperature hardnesses for all these materials. Also charted, as a basis for comparison, are hardness-temperature curves for two common valve body materials.



HARDNESS AT TEMPERATURE OF VARIOUS VALVE MATERIALS

1. A.S.T.M. A216—WCB—Valve body material.
2. A.S.T.M. A217—WC6—Valve body material.
3. Edward EValloy—400 BHN—Valve trim material.
4. Type 420—500 BHN—Valve trim, material.
5. Hastelloy 21—Heat treated, valve trim material.
6. Stellite No. 6—Valve trim material.

• • •

Edward EValloy, a 400 Brinell, low carbon high strength 13 per cent chromium stainless, employed by Edward since 1921, and the Type 420 (more brittle and slightly less corrosion resistant) high carbon, 13-16 per cent chromium stainless steels lose hardness rapidly above 750 F.

For toughness at higher temperatures, Stellite, a cobalt-chromium-tungsten alloy, and Hastelloy, a cobalt-chromium-molybdenum alloy hold hardness well to 1200 F, and are ideal for erosive throttling services at all temperatures. Of the two, Stellite is the more widely used for valve seating surfaces. Both have good corrosion resistance.

Monel metal, a copper-nickel alloy, and "18-8" chromium-nickel alloys lack high hardness needed for temperature and erosion resistance, but serve well in many corrosive services.

Edward

Service records here support BYERS Wrought Iron Pipe application here

Selecting genuine wrought iron pipe on the basis of past experience has become a common practice among many of the nation's leading designers. A typical example is the new DePaul Hospital Nurses' Home, St. Louis, Missouri. The outstanding service record established by this time-tested material in the nearby DePaul General Hospital since installation in 1930 provided the best possible support for the use of genuine wrought iron pipe in six vital services in the new building. Byers Wrought Iron pipe was utilized in all steam and return piping, all boiler room piping, water column, pump discharge and blow-off lines. Architects on the job were Maguolo and Quick; Harry F. Wilson was the engineer.

With today's maintenance costs so high, the importance of selecting the most durable material is obvious. The wisdom and economy of using Byers Wrought Iron pipe has been convincingly demonstrated in thousands of successful applications in every part of the country.

Our bulletin, WROUGHT IRON FOR PIPING SYSTEMS, discusses some of the corrosive conditions found in various services and illustrates a few of the many places where engineers have found greater economy in the longer life of genuine wrought iron. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

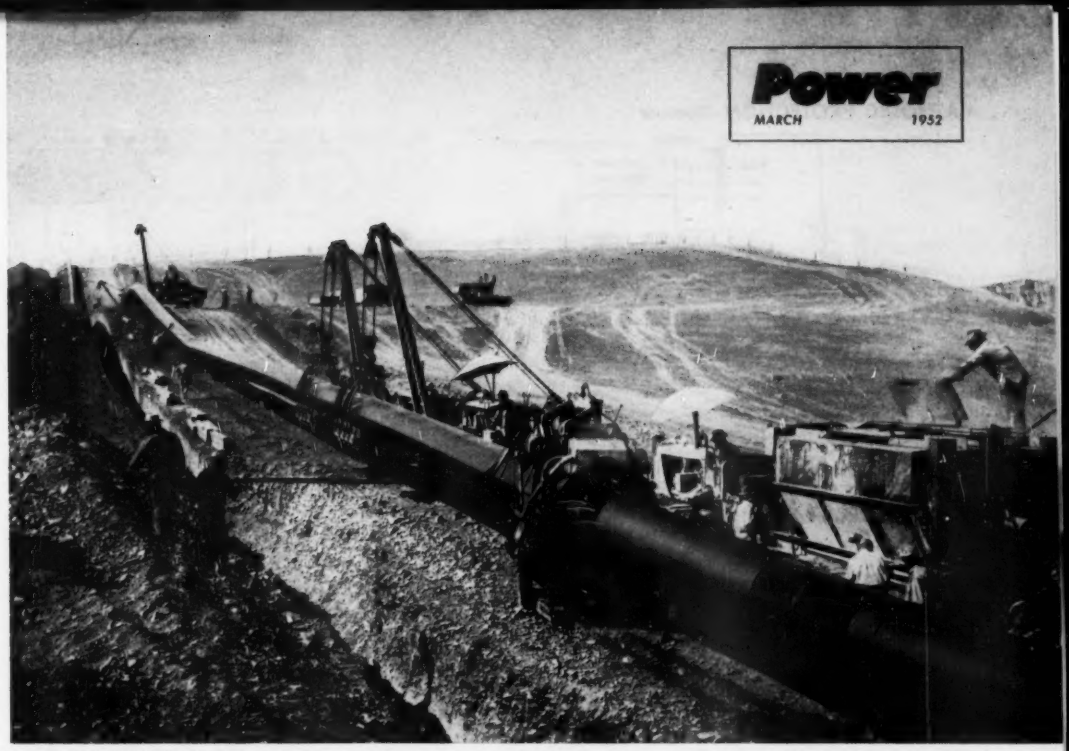
CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Power
MARCH 1952



WITH MORE MILEAGE than the railroads, underground pipelines—282,000 miles—have grown tremendously, are still growing. Cathodic protection serves them well. To reduce required power they're provided with this good insulation coat

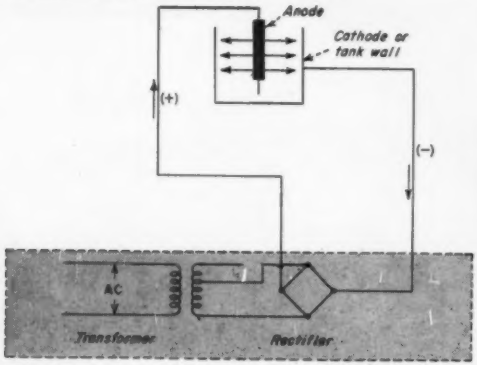
Cathodic Protection Checks Water Ills

WELDED UNDERGROUND PIPE provides a continuous electrical circuit. It does not require a special bonding

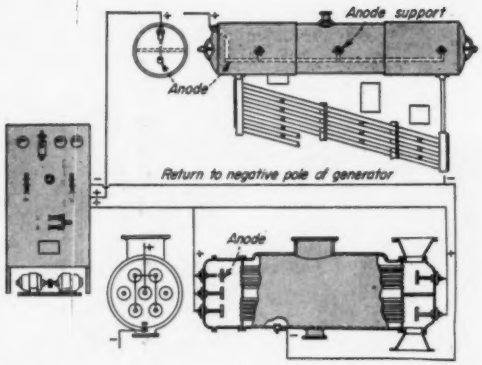
By **SHEPPARD T POWELL**, *Chemical Engineer*

- **Works well on low-pressure systems of simple geometric shape**
- **Gives excellent protection on pipelines buried in corrosive soils**
- **Supplies reliable control over salt and freshwater tank surfaces**
- **Requires proper current density, which has to be determined for each case**
- **Needs periodic check-up on effectiveness, particularly areas remote from electrodes**

MORE ON NEXT PAGE



1 Current supplied by an outside dc source connects to electrodes. Tank itself is the negative side of circuit



2 Kirkaldy protection system supplies a low-voltage dc to anodes in the water. Water serves as the electrolyte

LOSSES ARISING FROM ELECTROLYSIS OF VARIOUS METAL SURFACES IN CONTACT WITH WATER . . .

► FOR A NUMBER OF YEARS engineers have been applying electrolytic processes to protect metallic surfaces against corrosion. All these methods set up an opposing or counterelectromotive force to maintain the surfaces. This corrosion control is known as cathodic protection. If it can be brought about properly, it almost completely stifles corrosion activity.

How is this done? The theory behind it is simple enough. Metals are known to differ in electrode potentials, so any metal is more or less anodic to other metals. Thus, it's possible to arrange all metals in order of their electrode potentials in what is called the electromotive series.

Electromotive Series. You can see from Table I that zinc is anodic with respect to iron, that is, stands higher in this series. Current flows from zinc to iron when they are (1) submerged in an electrolyte or (2) connected electrically. The zinc corrodes and the iron is protected. In the same way iron, anodic with respect to copper, corrodes leaving copper untouched.

The principle is put to work by installing so-called "sacrificial" metals to protect the major metals. Back in 1824, Sir Humphrey Davy described cathodic protection that used zinc plates to prevent corrosion of copper sheathing covering a ship's hull.

All such electrolytic methods for preventing scale or corrosion fall into two classes: (1) creation of a cathodic surface by imposing an electric current on the metal, the current coming from an external source, and (2) creation of current generated by galvanic action, as in the Davy system, mentioned above.

The principle behind both classes is the same. They impose a direct current of low voltage and low amperage on the metal surfaces so the metal requiring protection is made the negative pole of a battery, while the anode or the sacrificial metal becomes the positive pole. In time the anode is consumed, but the cathode is protected.

This principle is used with varying success to prevent corrosion in low-pressure boilers, heaters, heat exchangers, condensers and other power-plant equipment. As far as the author knows no such treatment is used in any high-pressure boiler.

Galvanic Action. For many years it has been common practice to bond plates of zinc or other metals to power equipment to protect its surfaces. This particular method of cathodic protection suffers from several disadvantages: (1) Effectiveness diminishes as distance from the anode increases so areas more remote from the sacrificial metal get less protection than those close at hand. (2) In time, protective action slows down because a scale of insoluble zinc salts forms on this metal. (3) It must eventually be replaced.

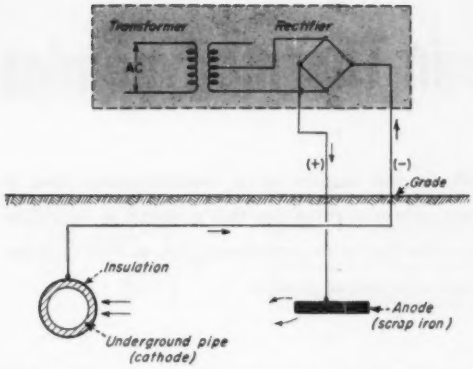
Despite these difficulties extensive experiments and widespread applications demonstrate this method to be both worthwhile and practical. It is being adopted as a corrosion-protective measure for many services, especially for protection of pipelines built in corrosive soils, and for fresh- and salt-water tanks.

Out of all this experience an awareness of control factors has developed. Some seem most important: (1) Imposed current must reach the entire cathode surface. (2) It must be uniformly distributed. (3) Amperage per sq ft of surface area must be determined for each individual water for best effectiveness. (4) If current runs too high, corrosion of anodes may be excessive, generating enough more oxygen to accelerate corrosion of metal outside the protected zone. When not carefully controlled, a cathodic-protection system may actually damage equipment it is meant to protect. These factors apply for both galvanic-action and external-current systems.

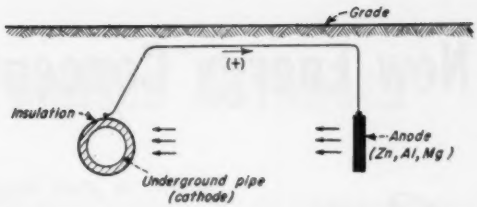
External Current. How do you apply the second method, developing a counterelectromotive force by supplying current from an external source? An outside voltage source is connected to suitable electrodes placed in the solution that touches the metal you want to protect. Amount of voltage is determined by the potential that must be built up to reverse normal currents prevailing between anodic and cathodic areas. The electrode operating at the controlling potential will then be anodic.

All surfaces influenced by current leaving the electrode will be cathodic. If this current density is high enough to stifle local action on the metal surface, corrosion protection has been achieved. Fig. 1 shows a simple wiring diagram for such a system. Positive side of an external dc source connects to the electrodes. Negative side of this external circuit attaches to the metal being protected, as shown in Fig. 1.

External source at 6-10 v must be dc: rectifiers, motor-generator sets,



3 Galvanic action can also protect underground pipes. With it zinc, aluminum, magnesium serve as protecting anodes



4 External circuit system for big pipeline requires anode metal supply large enough for a 2-year operating cycle

. . . DROP SHARPLY WITH CATHODIC PROTECTION

windmills with standby storage batteries, or any other dc source of adequate capacity. Dry-type rectifiers, of copper oxide, copper sulfide or selenium, serve most generally for cathodic-protection systems. Where the supply water varies widely in total solids content, applied voltage and current must be controlled as electrical resistivity of the water changes.

Electrodes, Fig. 1, may be carbon, graphite, mild steel, duriron, aluminum, magnesium, stainless steels, in fact, any material that resists rapid deterioration, introduces no objectionable product in the electrolyte, is mechanically strong, has low electrical resistance. Since the electrode acts as the anode, it supplies all wastage of metal or material if cathodic area is properly protected. This means the electrode must be large enough for relatively long, replacement-free service, yet provide enough surface to decrease resistance between electrode and electrolyte.

Table II gives enough information to estimate how fast the electrode metal wastes away. A metal with a low electrochemical equivalent has a low rate of dissolution per unit of current and time. To size an electrode properly, take into account amount of current delivered to the electrolyte. Further, remember the electrode metal wastes away somewhat faster than Table II shows because local corrosion currents cut down on the electrode's efficiency.

Electrode Setup. Number and arrangement of electrodes are based on the need to provide ample current density to all areas under protection. Don't forget, current density diminishes as distance from electrode to protected area increases. What's more, specific resistivity of water also influences current density so higher voltages must be supplied where water resistance to current passage is high. Many water tanks enjoy satisfactory protection from just one centrally located electrode. Others need several. In an elevated water tank, the bumped head needs special attention. Sometimes an electrode must be extended through the entire length of the tank's connecting riser.

Usually steel vessels of simple geometric shape like tanks or pipelines can be furnished with cathodic protection of considerable reliability. More complicated shapes, such as distillation columns or surface condensers, present more difficult and less predictable problems. Surface condensers usually carry electrodes in the water chambers near the tube sheets. Electrodes are always insulated from the surface they protect.

Current Density. Here are variables

(*Continued on page 202*)

TABLE I: ELECTROMOTIVE SERIES

Metal	Ion	Molal Electrode Potential at 77 F (25 C) Potential diff in volts
Magnesium	Mg^{++}	−2.34
Aluminum	Al^{+++}	−1.67
Zinc	Zn^{++}	−0.76
Chromium	Cr^{++}	−0.557
Iron	Fe^{++}	−0.44
Cadmium	Cd^{++}	−0.40
Nickel	Ni^{++}	−0.23
Tin	Sn^{++}	−0.14
Lead	Pb^{++}	−0.13
Hydrogen	H^{+}	Arbitrary zero point
Copper	Cu^{++}	+0.34
Silver	Ag^{+}	+0.80
Mercury	Hg^{++}	+0.80
Platinum	Pt^{++}	+1.2
Gold	Au^{+++}	+1.36

TABLE II: ELECTROCHEMICAL EQUIVALENTS OF ANODES

Anode	Valence	Sp Gravity	Lb per amp per yr	Cu in. per amp per yr
Aluminum	3	2.70	6.5	66.8
Carbon (graphite)	4	2.26	2.1	26.0
Iron	2	7.86	20.1	71.0
Nickel	2	8.90	21.2	66.2
Zinc	2	7.14	23.5	91.4
Magnesium	2	1.74	8.8	140.0

New Energy Concept in Thermodynamics

Power says—

Below, in plain English, is the upshot of a revolutionary idea in thermodynamics. Refuting accepted thinking, this presents a new flow equation to bring theory into line with experience, lay a firm foundation for progress in power-equipment design

WHAT IS THIS NEW THINKING?

Starting on the facing page is the world's first view of a revolutionary concept in thermodynamics, advanced by Prof Neil Bailey.

For many years standard thermo books have presented a certain "general-energy equation" as a foundation for the solution of problems of steady fluid flow. Up to now, deviations of experimental results from theoretical predictions were blamed on experimental and instrumental errors. In recent years, however, these discrepancies have become too great to be explained away.

Refusing to accept this unsatisfactory situation, Prof Bailey had the courage to question the accepted concepts of thermodynamics. The result is a logical revelation of hidden fallacies and a new, different flow equation, which checks closely with experiments on air and water.

Complete understanding of these new ideas demands the ability to follow the pattern of Bailey's mathematical logic, but our simple comments here will give the drift of this important revision in the basic sciences.

The standard steady-flow equation for water, steam or gas kept its eye on one pound of substance as it flowed through the process. According to this long-established theory, the total energy of the pound remains constant in steady flow. This constant-total was assumed to be composed of four parts: (1) potential energy (2) kinetic energy of the moving mass (3) internal energy of the dancing molecules (4) pressure times specific volume. This last was supposed to be a measure of the energy "stored" in the fluid because it is under pressure.

Bailey concludes that item (1) is an illusion because the fluid neither knows nor cares how far it is elevated above some arbitrary datum line of altitude. Then he wipes out (4) as a mere "counting your chickens twice," since the internal energy, item (3), is the total energy "in" the substance.

Finally, Prof Bailey finds it unprofitable to pursue one pound of substance through the equipment like a policeman chasing a suspected car. Instead, he seats himself at a "toll gate" and watches energy roll by. His new equation states that energy flow past one gate is the same as that past any other, if no energy is added or removed.

This total has three parts: (1) the internal energy in the pounds that pass the given point in one second (2) the kinetic energy in the pounds that pass in one second (3) what Bailey calls the "transmitted energy" per second. To get this last he multiplies pressure by duct-section area to find the push on an imaginary moving piston. This push, times the velocity, measures the transmitted energy per second.

WHAT DOES IT MEAN TO THE ENGINEERING WORLD?

If Bailey is right, parts of all thermo books, as well as books on aerodynamics and hydraulics, must be revised. Tables for gases and vapors will be in for some changes, as will computed boiler and turbine efficiencies. And straightforward computation will replace a lot of costly "cut and try" in development of turbines, pumps, jet engines, aircraft propellers and air foils.

Because Bailey's thesis is such a profound challenge to accepted thinking, the publication here of his pioneer paper is certain to cause a great stir in the world of thermodynamics, aerodynamics and hydraulics. Certainly every line of his argument will be subjected to critical examination by scores of specialists who have spent their lives in these fundamental fields of science.

Upsets Old Ideas, Promises Advances

Bailey says

Here, by special arrangement, Power presents the first announcement of new thermodynamic concepts advanced by Neil Bailey, Russell Sage professor of mechanical engineering at Rensselaer Polytechnic Institute. A forthcoming book gives further details

This spring Rensselaer Polytechnic Institute will sponsor a technical meeting at which important changes in the theory of thermodynamics, aerodynamics and hydraulics will be discussed. Experimental procedures will be exhibited that demonstrate fundamentals not grasped up to now.

This article is but a brief survey of many years of sustained effort to improve the *everyday usefulness* of thermodynamic analysis and prediction. A far more complete presentation in book form is currently in press by the McGraw-Hill Book Co. In this book the rather simple physical approach to applied thermodynamics is extended into many areas not mentioned here.

The book considers duct flow with friction and turbulence, flow with work input and heat release, along with other forms of discontinuities and instabilities, batch or intermittent processes, such as intake and exhausting of reciprocating engines. Even the power cycles of classical thermodynamics are much simplified by an approach making it possible to follow actual processes as well as ideal ones.

Concurrently, tables of gas properties, vapor properties and useful functions are in preparation which McGraw-Hill will issue shortly after the book comes out.

The Problem. Theoretical analyses of thermodynamic processes are plagued by more and more experimental observations that theory fails to explain or predict. Much effort goes to inventing correction factors that span an ever-widening gap between theory and practice. Measured flow rates don't check predictions, unexpected temperatures are found, discontinuities and instabilities are not anticipated.

Classical thermodynamics, now a century old, was developed for static processes and ideal cycles. Basic concepts of fluid flow are essentially those of 1850 hydraulics. Modern engineering thermodynamics concocted from those two older subjects has not been built up as a consistent unit.

Workers in this field come to an inescapable conclusion that somewhere along the line of development errors have been built into the subject. In what follows these errors are isolated and the corrected analysis verified. The significance is worked out in several important areas and other implications are pointed out.

Energy Concepts. Work is uniquely defined by a force acting through a distance. This states the only way that mechanical energy can be transmitted from one system to another. Moving fluid streams possess kinetic energy because they are flowing, and gases and vapors possess internal energy by virtue of molecular motion and spacing.

Liquids in elevated positions are often assumed to have energy because of their position, but they actually do not possess such energy. The elevation merely defines a state with respect to the earth. The liquids can receive this energy only as they move down hill and the force of gravity actually performs this promised work. If they never descend, they will never have this energy.

This contrasts with the true potential energy of a compressed spring that does have internally stored energy from elastic stress forces having moved through deformation distances.

Fluids are often referred to as possessing energy because they exist under pressure. Again, this pressure merely defines a state and does not represent energy. A non-compressible fluid that will not deform can be raised to any pressure with zero work input because the force applied moves through no distance. When a gas or vapor has its pressure raised, there is work input because the compressing force acts through a deformation distance. However, like the spring, this input work stays as internal energy in the gas. If work is done on release of this pressure, its only source is the stored internal energy. *A fluid at rest possesses only internal energy.*

Energy Flow. Energy can be moved from one place to another by a flowing stream in three ways. *Kinetic energy* is *transported* at a rate $Wv^2/2g$ by W lb per sec of fluid moving at velocity v ft per sec. *Internal energy* is *transported* at a rate Wu by W lb per sec possessing u ft lb per lb of internal energy.

In addition, the fluid stream *transmits* energy at a rate *Pav:* An absolute pressure P across an area a constitutes a force Pa moving along at a flow velocity v.

This gives the total rate of energy flow WE as:

$$WE = Wu + Wv^2/2g + Pav \qquad (1)$$

Total = internal + kinetic + transmitted

As a fluid flows along, exchanges between these three forms of energy can occur and their total WE can vary.

Kinetic and internal energy that are *transported* are obvious and measurable, but the *transmitted* energy flow *Pav* is less evident. Its existence can be seen by thinking of water flowing down a hill to a turbine, through a constant-area pipe. As it comes down gravity does work on it, but its kinetic energy cannot change and its internal energy is negligible.

The work of gravity increases *Pav* by raising P. The entire work of gravity is delivered to the turbine as transmitted energy flow *Pav*. Stopping the flow stops the transmitted energy because the existing force Pa is not moving and gravity does no work.

Energy Conversion. Transmitted energy *Pav* is not physically obvious but is very significant. Only through changes in it can there be changes in kinetic and internal energy. Kinetic energy can change only through a force change $d(Pa)$, and internal energy cannot change without a volume change $d(av)$.

In absence of turbulence or heat transfer, internal energy flow Wu can be changed mechanically only by a force acting through a deformation distance. This means that a change dV in the specific volume V must occur with a pressure P if the internal energy is to be altered. For a steadily flowing fluid:

$$W du = -WPdV = -Pd(av) \qquad (2)$$

since for steady flow

$$WV = av \qquad (3)$$

Use the minus sign because a gain in volume $+dV$ represents a loss in internal energy. Change in volume flow av is made up of two parts:

$$W du = -Pd(av) = -Padv - Pvda \qquad (4)$$

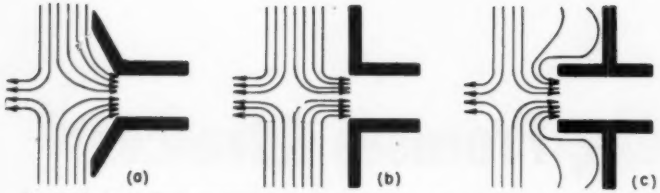
The change adv is a space change in the flow direction and vda is an expansion in a direction normal to the flow velocity. Both changes are with a pressure P so they both represent internal energy changes. But they have widely different effects on flow.

In classical thermodynamics, volume change dV was used as an algebraic quantity. This was all right in a closed engine cycle when only piston motion could give a volume change dV, but it cannot be so used with a *flowing* medium.

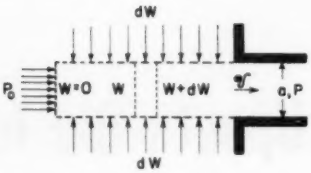
In the special case of a non-compressible medium, such as a liquid, dV is zero and vda must equal $-adv$.

Energy Conversion in Space Flow. Flow in free space, such as a wind blowing or fluid flowing in a large space toward an opening or around an obstruction, involves certain concepts. A *flow tube* is surrounded by an imagined boundary enclosing a varying flow area inside of which there is always a statistically constant flow of molecules. Constant-weight flow, W lb per sec, in such a tube must accelerate and decelerate in equilibrium with surrounding tubes if turbulence and mixing are to be avoided.

In such a tube, energy conversion *Padv*, equation (4), is in direction of flow and can change transmitted and kinetic ener-



1 Walls direct flow into nozzles: (a) partial nozzle with extra entering momentum (b) plane tube, normal entering momentum (c) re-entrant tube, lower momentum



2 Conditions defining flow of fluid in a "space tube," ready to enter nozzle

gies. The transverse energy conversion $Pvda$ is absorbed or supplied by adjacent flow tubes.

To say that the imagined molecular boundary of a tube could retain or reflect such transverse expansion energy would deny the very molecular process by which expansion occurs and internal energy changes are brought about.

This means that with space flow, even though an amount of internal energy Wu is being transported only the energy change $-Padv$ affects the transmitted and kinetic energy. The transverse energy change $-Pvda$ represents an exchange between flow tubes. For space flow, equation (1) becomes:

$$d(WE)=d(Wu)+d(Wv^2/2g)+d(Pav) \quad (5)$$

$$-Pvda= \quad (6)$$

$$-Pvda-Padv+d(Wv^2/2g)+d(Pav) \quad (7)$$

$$(W/g)vdv+vd(Pa)=0 \quad (8)$$

$$(W/g)dv+d(Pa)=0 \quad (9)$$

Equation (8), derived for space flow from an energy approach, can be recognized as a constant-weight flow version of Newton's second law, the rate of change of momentum equals the applied force or

This says that for space flow where there are no forces exerted by duct walls, flow is at constant momentum.

Energy Conversion in Duct Flow. When a steady-weight flow W lb per sec of fluid is guided non-turbulently by the solid walls of a duct, the energy conversion is somewhat different. As before, the energy change $-Padv$ acts directly to alter the kinetic and transmitted energy. The transverse energy conversion $-Pvda$, which was exchanged between flow tubes in space, is now contained within solid duct walls. Through the mechanism of molecular reflections at the solid walls, this transverse energy change is redirected into the flow direction.

This means that the total energy flow WE of (1) is constant so

$$-Pd(av)+d(Wv^2/2g)+d(Pav)=0 \quad (10)$$

$$(W/g)vdv+avdP=0 \quad (11)$$

but

$$WV=av \quad (12)$$

$$(vdv/gV)+dP=0 \quad (13)$$

Equation (13) for duct flow is usually derived from a force point of view by summing up forces on an element in the flow direction. Because the same force diagram is always drawn, it has been assumed to apply also to space flow.

However, an energy approach makes it clear that:

a. *Flow in ducts is at constant energy and variable momentum.*

b. *Flow in space is at constant momentum and variable energy.*

Flow From Rest. Fluid flowing in any duct must at some point enter from a large space so this entering process is of primary importance. At rest in space a fluid possesses only internal energy regardless of the pressure at which it exists. Pressure does influence the amount of energy that can be removed from a space by a flowing fluid, but the only source of such energy is the internal energy stored in the space or the energy source supplying fluid to the space.

From equations (1) and (3) energy flow into an opening of area a is:

$$\frac{WE}{a}=\frac{uv}{V}+\frac{v^3}{2gV}+Pv \quad (14)$$

This changes with varying velocity depending on how velocity affects the leaving pressure and internal energy.

The manner of this variation is influenced somewhat by the way the walls direct the entering flow, Fig. 1. The most common and important case[1] is the plane entrance of Fig. 1b. For this case, the only entering momentum is that supported by the supply pressure P_o.

When W lb per sec of fluid flows in a tube in space, (9) gives the condition at any point as

$$(Wv/g)+Pa=constant \quad (15)$$

This form of the constant momentum equation is useful for studying the flow of Fig. 2 by combining it with (3) to give

$$a[P+(v^2/gV)]=constant \quad (16)$$

This equation applied to Fig. 2 gives

$$P_oa=a[P+(v^2/gV)] \quad (17)$$

$$P_o-P=v^2/gV \quad (18)$$

Tests[1] indicate that the wall shape around a duct entrance can cause a variation of as much as plus or minus 20% in the pressure drop (P_o-P) required to produce a flow velocity v into a duct opening. Value for a plane entrance given by (18) may be safely taken as a normal condition because the maximum variations observed do not all change the nature of the conclusions that follow from combining (14) and (18)

$$\frac{WE}{a}=\frac{uv}{V}+P_ov-\frac{v^3}{2gV} \quad (19)$$

This equation says that *for a fluid leaving a still space, the energy per second leaving through an opening of area a builds to a maximum and then decreases as the leaving velocity increases.*

Working Variables. Since flowing fluids possess both kinetic and transmitted energy, the flow situation is not defined without specifying both of them. A certain amount of kinetic energy with a low transmitted energy will not result in the same flow situation as the same kinetic energy with a higher transmitted energy.

This means velocity v alone is not a proper variable to use in studying flow. It is vital to consider the pressure P that accompanies the velocity; otherwise transmitted energy is not defined.

To care for this the *kinetic energy ratio* N^2 is defined by

$$N^2=\frac{kinetic\ energy}{transmitted\ energy} \quad (20)$$

$$=\frac{Wv^2/2g}{Pav}=\frac{v^2}{2gPV} \quad (21)$$

Corresponding internal energy ratio is

$$Internal\ energy\ ratio=Wu/Pav=u/PV \quad (22)$$

Another very useful concept is

$$N=velocity\ ratio$$

$$=\sqrt{kinetic\ energy\ ratio}$$

$$=v/\sqrt{2gPV} \quad (23)$$

In terms of these ratios, entering pressure ratio for all fluids from (18) is defined by

$$P_o/P=1+2N^2 \quad (24)$$

When gases and vapors undergo internal energy changes, value of the transmitted energy during the conversion is significant. Another very useful concept is

$$Conversion\ factor=\frac{\int W\,du}{Pav}=\int\frac{du}{PV} \quad (25)$$

Liquid Flow Into Ducts. For liquids, internal energy u is considered zero and energy flow equation (19) takes the form

$$\frac{WE}{a}=P_ov-\frac{v^3}{2gV}=P_v\left(\frac{P_o}{P}-\frac{v^2}{2gVP}\right) \quad (26)$$

$$\frac{WE}{P_oa(2gP_oV)^{1/2}}= \quad (27)$$

$$\left(\frac{P}{P_o}\right)^{3/2}\frac{v}{(2gPV)^{1/2}}\left(\frac{P_o}{P}-\frac{v^2}{2gPV}\right)$$

Combining this with (24)

$$\frac{WE}{P_oa(2gP_oV)^{1/2}}=\frac{N(1+N^2)}{(1+2N^2)^{3/2}} \quad (28)$$

This, with (24), completely defines the energy flow of a liquid entering a duct from a pressure P_o for normal entrance of Fig. 1b.

Fig. 3 shows that maximum possible energy flow of a liquid from a free space occurs at a velocity ratio of $N=1.0$ and under pressure ratio $P/P_o=⅔$. Careful tests[2] of straight tubes of length-diameter ratios of 1.0 to 4.0 show instability in the range given on Fig. 3.

Below $P_o/P=3.0$ and $N=1.0$, the tube flows full, and at or near $N=1.0$, the flow breaks clear of the tube walls. Simultaneously a high-pitched whistling begins, indicating an instability at the zero slope point of Fig. 3. At higher-pressure ratios the jet remains separated and between P_o/P of 4 and 5 the whistle passes out of the audible range (12,000 cycles per sec).

Upon again reducing the pressure ratio carefully to a value less than P_o/P of 3.0 the jet often remains separated for a time in a metastable state. In the range just below $P_o/P=3.0$, straight-walled tubes are extremely unstable.

Gas Flow Into Ducts. When a gas flows from a space into a duct both the specific volume V and the internal energy u change so the complete energy flow equation must be used (14). This can be written as

$$\frac{WE}{aP_o(2gP_oV_o)^{1/2}}= \quad (29)$$

$$\left(\frac{P}{P_o}\right)^{3/2}\left(\frac{V}{V_o}\right)^{1/2}N\left(\frac{u}{PV}+N^2+1\right)$$

where P_o and V_o refer to conditions in the supply space. Pressure required is given by (24).

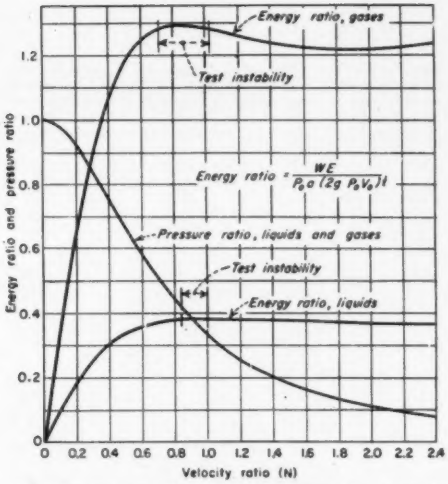
Specific volume V and internal energy u can be related for a gas through the conversion factor (25). For no heat transfer or turbulence

$$du=-PdV \quad (30)$$

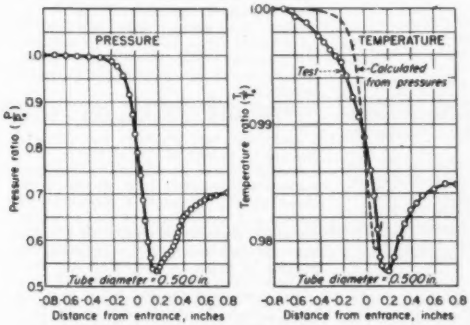
$$-\int\frac{dV}{V}=\int\frac{du}{PV} \quad (31)$$

1—Unpublished tests, ME Dept, Rensselaer Polytechnic Institute, 1951; p 836, *Theoretical Mechanics*, by Weisbach, Van Nostrand, 1882; p 364, *Mechanics and Engineering*, Vol 1, by Weisbach, Lea and Blanchard, 1848.

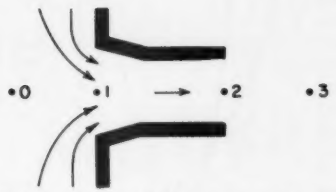
2—*Flow Stability in Small Orifices*, by R P Northrup, presented at Nov 30, 1951 annual meeting of American Rocket Society. 1951-52 unpublished tests in RPI ME Dept laboratories.


Energy ratio, gases
Test instability
Energy ratio = WE / P₀ a (2g P₀V₀)t
Pressure ratio, liquids and gases
Test instability
Energy ratio, liquids
Energy ratio and pressure ratio
Velocity ratio (N)

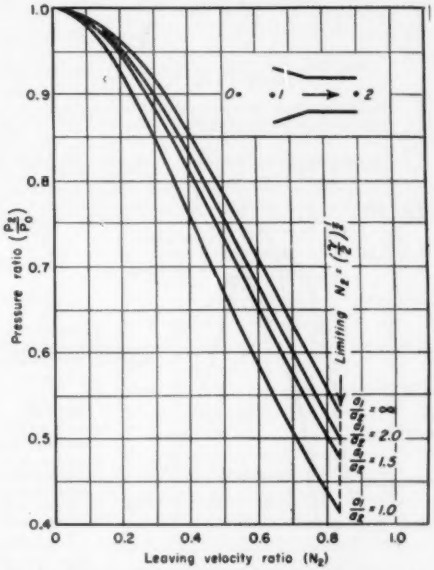
3 For gas and liquid flows from space into tubes the energy and pressure ratios vary with velocity ratio



4 Typical pressure and temperature traverses of air flow from space into a straight tube 0.5 in. dia



5 Typical points at which pressure and temperature was measured for fluid flow through a flow nozzle



6 Velocity ratio produced by any pressure ratio depends on ratio of the nozzle inlet and outlet areas

For an ideal gas

$$PV = RT \text{ and } du = JCdT \quad (32)$$

where T is temperature in deg R, and C is internal energy specific heat. Equations (31) and (32) can be combined with

$$\gamma = \frac{R}{JC} + 1 = 1.4 \text{ for air} \quad (33)$$

to give the familiar relationship

$$\left(\frac{V_o}{V}\right)^{\gamma} = \frac{P}{P_o} \quad (34)$$

This gives for an ideal gas

$$\frac{WE}{aP_o(2gP_oV_o)^{1/2}} = \left(\frac{P}{P_o}\right)^{3/2}\left(\frac{P}{P_o}\right)^{-1/2\gamma} N\left(\frac{JC}{R} + 1 + N^2\right) \quad (35)$$

Using (24)

$$\frac{WE}{aP_o(2gP_oV_o)^{1/2}} = \frac{N\left(\frac{\gamma}{\gamma-1} + N^2\right)}{(1+2N^2)^{3/2-1/2\gamma}} \quad (36)$$

Energy flow of a gas entering an opening from a supply pressure P_o shown by Fig. 3 reaches a maximum at $N = (\gamma/2)^{1/2}$ and $P_o/P = 1+\gamma$, and a minimum at $N = (\gamma/\gamma-1)^{1/2}$, after which it again increases.

Repeated tests of many tubes show instability always at the top of the energy flow curve, as on Fig. 3. In the previous case of water, the jet separated from the tube walls, but with air, instability takes another form. The flow surges violently, appearing to completely collapse and reform each cycle. The frequency is lower than for water and heavy energy surges are involved.

Fig. 4 shows typical traverses for such a tube with a pressure ratio just before bad instability starts.

Liquid Nozzles. Space flow of a liquid into a straight-walled tube becomes unstable at an absolute pressure ratio of $P_o/P_1 = 3.0$ because this point represents the maximum energy flow that can enter the duct.

Requirements for a stable liquid nozzle can be deduced from Fig. 5, in which the flow from P_o to P_1 is space flow at constant momentum. Flow from P_1 to P_2 is duct flow at constant energy. From Eqs (19) and (14) for a liquid, the entering energy at 1 is the same as that leaving at 2.

$$WE = P_o v_1 a_1 - \frac{v_1^3 a_1}{2gV} = \frac{a_2 v_2^3}{2gV} + P_2 a_2 v_2 \quad (37)$$

For steady flow

$$WV = a_1 v_1 = a_2 v_2 \quad (38)$$

$$\frac{P_o}{P_1} - N_1^2 = \frac{N_1^2 a_1^2}{a_2^2} + \frac{P_2}{P_1} \quad (39)$$

Critical entering condition occurs when

$$N_1^2 = 1.0 \text{ and } P_1 = P_o/3 \quad (40)$$

This gives a critical pressure ratio for any area ratio

$$\left(\frac{P_2}{P_o}\right)_{critical} = \frac{2 - a_1^2/a_2^2}{3} \quad (41)$$

This says that while a straight-walled tube becomes unstable at $P_2/P_o = 1/3$, a tube with a taper of $a_1/a_2 = (2)^{1/2}$ will have no critical pressure ratio.

a_1/a_2	Critical P_2/P_o Theory	Test
1.0	.33	.38
1.21	.18	.28
1.44	none	none

Table above gives a summary of many tests of tapered tubes. A taper of a_1/a_2 of 1.44 resulted in a tube that could not be put into instability as predicted. Tests on tubes of area ratio a_1/a_2 of 1.0 and 1.21 became unstable at lower than predicted values of P_o/P_2, primarily because of the flat-topped nature of the energy-flow curve.

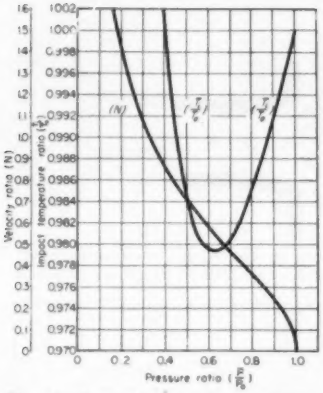
Since about 1860 it has been accepted practice to assume space flow is at constant energy, the same as duct flow. Equation (13) has been applied to the nozzle of Fig. 5 to give

$$\frac{1}{gV}\int_{v_o}^{v_2} v\,dv + \int_{P_o}^{P_2} dP = 0 \quad (42)$$

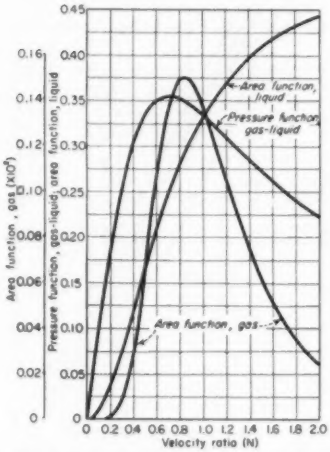
or,

$$\frac{v_2^2}{2gV} = P_o - P_2 \quad (43)$$

The discharge so calculated has failed to check tests, so a discharge coefficient C_D



7 For air flow from space, impact temperature ratio goes through minimum



8 Area and pressure function variation for space flow of gases and liquids

was then used to give

$$Flow\ rate = C_D a_2 \left[2gV(P_o - P_2)\right]^{1/2} \quad (44)$$

However, using space flow ahead of the nozzle from (38) and (37) gives

$$P_o - \left(\frac{a_2}{a_1}\right)^2 \frac{v_2^2}{2gV} = \frac{v_2^2}{2gV} + P_2 \quad (45)$$

or,

$$Discharge\ rate = a_2 v_2 = a_2 \left[\frac{2gV(P_o - P_2)}{1 + \frac{a_2^2}{a_1^2}}\right]^{1/2} \quad (46)$$

Comparing Eqs (46) and (44) shows

$$\frac{1}{C_D} = \left(1 + \frac{a_2^2}{a_1^2}\right)^{1/2} \quad (47)$$

	Test C_D		
a_1/a_2	*Below critical (full)*	*Above critical (separated)*	*Calculated C_D Eq (45)*
1.00	.81	.63	.71
1.21	.88	.76	.77
1.44	.91	.91 (stable)	.83

Table above shows typical test results for small tubes of a length-diameter ratio of 4.0. Comparison should be made between the calculated values and the test values below the critical. Assumption that space flow ceases and duct flow begins immediately at point 1, Fig. 5, does not square with test observations. Space flow appears to persist some into entrance of tube, so more energy actually enters than was assumed.

Gas Nozzles. When a gas flows into a nozzle, Fig. 5, the fact that it is constant-energy duct flow from 1 to 2 is stated by

$$WE = Wu_1 + W\frac{v_1^2}{2g} + P_1 a_1 v_1$$

$$= Wu_2 + W\frac{v_2^2}{2g} + P_2 a_2 v_2 \quad (48)$$

Using Eqs (33) and (34) gives

$$\frac{P_1}{P_2}\left(\frac{\gamma}{\gamma - 1} + N_1^2\right)^{\gamma/\gamma - 1} = \left(\frac{\gamma}{\gamma - 1} + N_2^2\right)^{\gamma/\gamma - 1} \quad (49)$$

The steady-flow equation

$$W = \frac{a_1 v_1}{V_1} = \frac{a_2 v_2}{V_2} \quad (50)$$

may be written as

$$\frac{a_1 N_1}{a_2 N_2} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma + 1}{2\gamma}} \quad (51)$$

These can be combined to give

$$\frac{N_1}{\left(N_1^2 + \frac{\gamma}{\gamma - 1}\right)^{\frac{\gamma + 1}{2(\gamma - 1)}}} \frac{a_1}{a_2} = \frac{N_2}{\left(N_2^2 + \frac{\gamma}{\gamma - 1}\right)^{\frac{\gamma + 1}{2(\gamma - 1)}}} \quad (52)$$

Function of N_2 of (52) reaches a maximum value at $N_2 = (\gamma/2)^{1/2}$, so for any nozzle, a_1/a_2 the entering velocity ratio N_1 cannot become greater than that corresponding to an N_2 of $(\gamma/2)^{1/2}$.

Physically, this means that as P_o, the supply pressure, is raised, the pressure ratio across the nozzle and its approach will not exceed a value to produce this N_2. Further increases will only cause P_2 to rise.

Equations (49) and (51) can be solved in many ways, together with the space flow equation

$$P_o/P_1 = 1 + 2N_1^2 \quad (53)$$

One very useful form, Fig. 6, shows that the velocity ratio N_2 produced by an overall pressure ratio P_2/P_o depends on the area ratio a_1/a_2 of the nozzle. Also, it shows that the critical pressure ratio at which N_2 reaches a maximum of $(\gamma/2)^{1/2}$ depends on the nozzle design. It is small wonder that so many values of nozzle coefficients have been necessary in the past. The conclusions of Fig. 6 are well substantiated by tests.

Temperature Concepts. It has been the custom to assume that a liquid flowing from a region at pressure P_o removes with it an amount of energy $P_o V_o$ per lb. However, it can be shown that with space flow

$$\frac{E}{P_o V_o} = \frac{1 + N^2}{1 + 2N^2} \quad (54)$$

where N is the leaving velocity ratio. This varies from unity at an N of zero to a minimum of $E/P_o V_o = \frac{2}{3}$ at the limiting leaving N of unity.

With ideal gases it has always been assumed that the energy removed per lb is

$$E = JCT_o + P_o V_o = \frac{P_o V_o}{\gamma - 1} + P_o V_o \quad (55)$$

or,

$$\frac{E}{P_o V_o} = \frac{\gamma}{\gamma - 1} \quad (56)$$

It can be shown that with space flow

$$\frac{E}{P_o V_o} = \frac{\frac{\gamma}{\gamma - 1} + N^2}{(1 + 2N^2)^{\gamma - 1/\gamma}} \quad (57)$$

This varies from a maximum of $E/P_o V_o$ of $\gamma/(\gamma - 1)$ at a leaving N of zero to a minimum value of $\{\gamma(1+\gamma)^{1/\gamma}\}/\{2(\gamma-1)\}$ at the maximum stable leaving – velocity ratio of $N = (\gamma/2)^{1/2}$.

Temperature concepts can be readily visualized in terms of energy equation (1). The *static temperature* T measures only internal energy u and is not conscious of transmitted or kinetic energy. A stationary thermometer, which reads *impact temperature* T_i, is not aware of transmitted energy Pav, which can only be calculated.

Ratio of impact temperature T_i to original supply temperature T_o is

$$\frac{T_i}{T_o} = \frac{Wu + W\frac{v^2}{2g}}{Wu_o} = \frac{PV}{P_o V_o} \frac{\left(\frac{u}{PV} + \frac{v^2}{2gPV}\right)}{\frac{u_o}{P_o V_o}} \quad (58)$$

For space flow into a duct

$$\frac{T_i}{T_o} = \left(\frac{P}{P_o}\right)^{\gamma - 1/\gamma} \frac{\left[\frac{1}{\gamma - 1} + N^2\right]}{\frac{1}{\gamma - 1}} = \left(\frac{P}{P_o}\right)^{\gamma - 1/\gamma} \left[1 - \frac{\gamma - 1}{2}\left(\frac{P_o}{P} - 1\right)\right] \quad (59)$$

Fig. 7 for air shows that with space flow T_i/T_o has a minimum value of .979 at a pressure ratio $P/P_o = 1/(3-\gamma) = .625$ corresponding to $N = .546$. Fig. 4 shows typical experimental values and a comparison of calculated and experimental temperatures. The calculated temperature curve was reckoned from pressure curve and theoretical curve of Fig. 7. Classical thermodynamics assuming total temperature remains constant for all flow involves two misunderstandings:

First, it assumed that an amount of energy $E/P_o V_o = \gamma/(\gamma - 1)$ always came from a space with each pound of gas. Actually, this can be as little as 0.94 at times.

Second, it was thought that the impact temperature measures total energy E. As shown by Fig. 7 and 4, it measures only kinetic and thermal energy and is unconscious of transmitted energy. Result has been an elaborate system of velocity corrections for impact thermometers that were far from convincing.

Space Flow of Fluids. When fluids in space already flowing at conditions 2 have to adjust to new conditions 3 as when leaving the nozzle of Fig. 5, it is again space flow at constant momentum.

$$\frac{W}{g} v_2 + P_2 a_2 = \frac{W}{g} v_3 + P_3 a_3 \quad (60)$$

For steady flow

$$W = a_2 v_2 / V_2 = a_3 v_3 / V_3 \quad (61)$$

Eliminating areas gives

$$\frac{N_3}{1 + 2N_3^2} = \left(\frac{P_3 V_3}{P_2 V_2}\right)^{1/2} \frac{N_2}{1 + 2N_2^2} \quad (62)$$

For gases this becomes

$$\frac{N_3}{1 + 2N_3^2} = \left(\frac{P_3}{P_2}\right)^{\frac{\gamma - 1}{2\gamma}} \frac{N_2}{1 + 2N_2^2} \quad \text{(gas-press. function)} \quad (63)$$

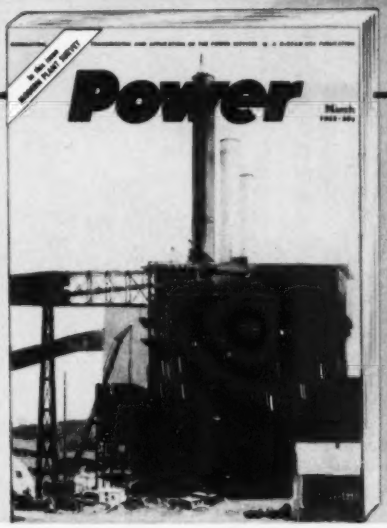
For liquids it is

$$\frac{N_3}{1 + 2N_3^2} = \left(\frac{P_3}{P_2}\right)^{1/2} \frac{N_2}{1 + 2N_2^2} \quad \text{(liquid-press. function} \quad (64)$$

Fig. 8 shows this space flow pressure function $N(1+2N^2)$ has a peak value at $N = (1/2)^{1/2} = .707$. From either Eq (63) or (64) it may be seen that a fluid flowing in space toward a lower pressure P_3 can do either of two things, depending on the initial N_2. If N_2 is less than 0.707, the flow will flow to the lower pressure at decreasing N_3. If N_2 is greater than 0.707, it will flow into the lower pressure with an N_3 greater than N_2.

If pressures are eliminated from Equation (63), the result for gases is

(Continued on page 234)



presents its

1952 MODERN PLANT SURVEY

Quick summaries of design trends; technical details of over 500 central-station and industrial steam units, 125 hydro projects

How to Use Survey Facts Most Effectively

The following pages bring you the most complete data available anywhere on the design features of steam and hydro units planned, under construction and starting operation. But because of the way we must compile the facts, the survey does *not* include *all* current programs, nor does it consist entirely of strictly current construction. Here we tell you briefly how the job is done, and point out specific limitations of the listings, all with the idea of helping you to use the facts most effectively.

● **HOW WE DO THE JOB.** As a continuing service, POWER's editors assemble news of installations planned or ordered. From these records, questionnaires are mailed to the individual companies, asking details of their projects. The replies form the basis for the tables, which are compiled at approximately yearly intervals. The last such tables appeared in December 1950.

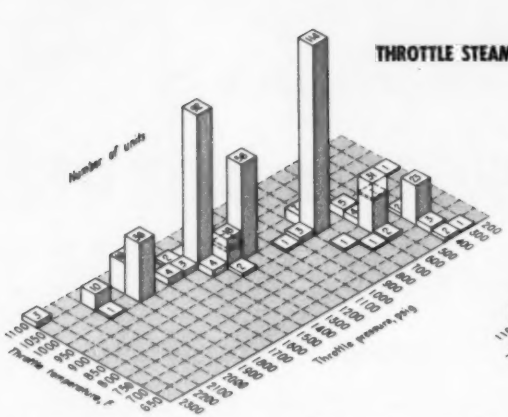
● **ITS LIMITATIONS.** It can be seen that, in the nature of things, these tabulations cannot be complete. Nor can the published list correspond exactly in point of time with actual installations or announcements of them. If engineering begins early, data may appear in the tables well before start of plant construction.

On the other hand, many installations do not appear in the tables until long after the plans are widely known. This simply means we're waiting for engineering to progress to a point where the plant owner can supply full technical information. In such cases, we keep after the job and when the data become available they are listed. Each set of tables is checked against preceding ones to avoid any duplication of listings.

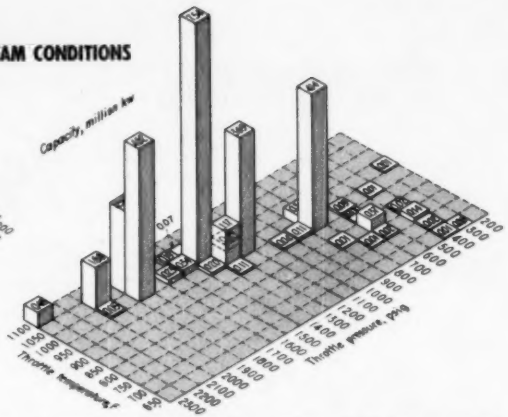
● **HOW TO USE SURVEY.** Being *representative* of design and construction work in progress in 1951 and early 1952, the following tables yield useful information on general trends. We have charted some of these technical trends for your convenience on pp 80, 81, 88, 89 and 97.

And, of course, the tables are highly useful for satisfying your curiosity about details of specific central-station or industrial installations.

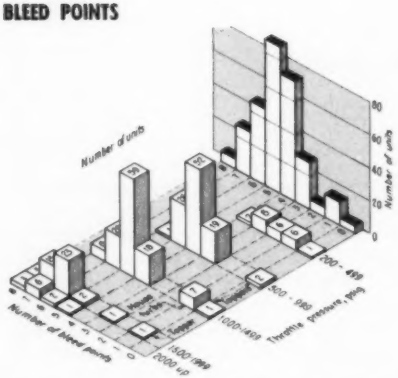
● **HOW NOT TO USE IT.** Remember, these are not complete lists, only extensive samples. **Do not use the survey facts to arrive at total figures on capacities, sales, etc., or to make comparisons where lack of completeness will distort the results.**



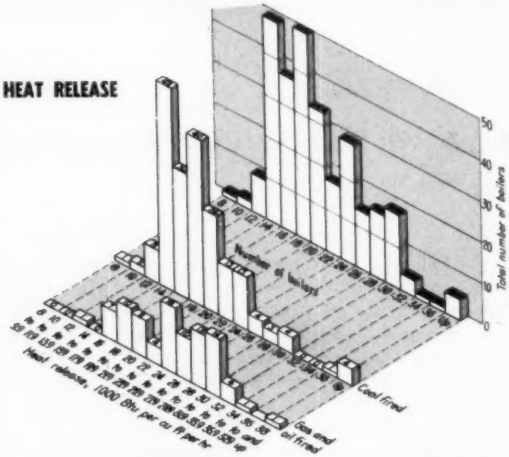
1 New units make a greater use of high steam pressures and temperatures, with 1100 F appearing for first time, at left



2 Tall bars show that bulk of new capacity going in service uses high steam conditions. Compare with Fig. 1, at left



5 Striving for greater efficiency to offset high fuel costs leads to increasing use of more bleed points per turbine



6 Furnace design gets set for coping with poorer coals by providing for low heat releases. Oil and gas run higher

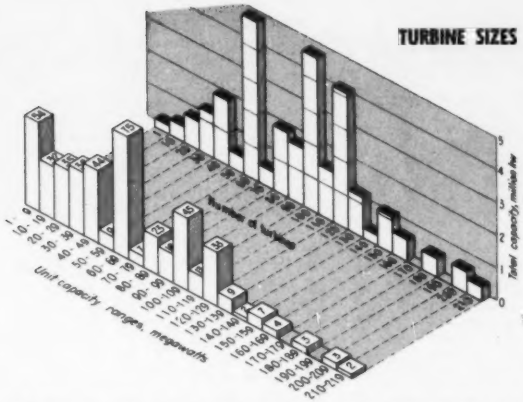
Trends in UTILITY PLANTS

Over 22,200,000 kw of new steam capacity will start operating during the years 1951, 1952 and 1953. Over 4,-200,000 kw are scheduled for 1954. Fig. 1 to 9 show some major trends of these new plants. POWER surveys, published in October 1948, September 1949, December 1950 and the current one on the following pages, include over 97% of the kw capacity installed in and scheduled for 1951 through 1953. For the period 1951 through 1954, these surveys include over 85% of all capacity.

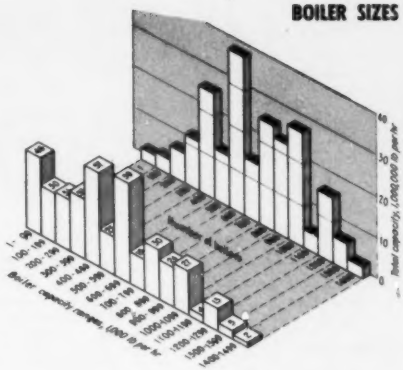
Firsts. Current survey includes for the first time boilers of 1,400,000 lb per hr, turbines of 200,000 kw, temperatures of 1100 F, heat releases less than 10,000 Btu per cu ft per hr.

These reflect the cry for more and more power in America. Hemmed in by rising costs in all aspects of power generation, today's designers meet the challenge by vigorously pushing into the realm of higher steam pressures and temperatures, turning to larger equipment units, more regenerative feed heating, multiple-fuel firing, utilization of poorer fuels, centralization of controls.

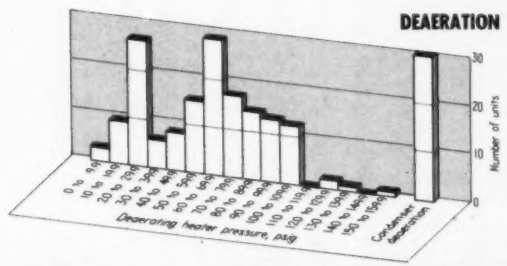
Perhaps the biggest boost to realizing higher station efficiency has been the remarkable acceptance of reheat units. Fig. 8 shows that, in the period surveyed, 144 reheat units will be started against 306 straight regenerative. From a capacity standpoint, however, reheat will supply over 15,000,000 kw,



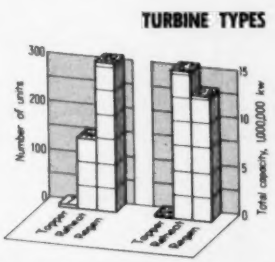
3 Increasing use of large units shows tremendous growth of utility systems. 200,000-kw units appear as new maximum



4 Steam generators also grow in maximum size, with giants of 1,400,000-lb capacity. Distribution parallels turbines



7 Deaeration pressures vary widely with average centering around 60 psia; about 15% deaerate in main condenser only



8 Outstanding trend in new installations is the number of reheat units going in, 31% of units and 54% of capacity

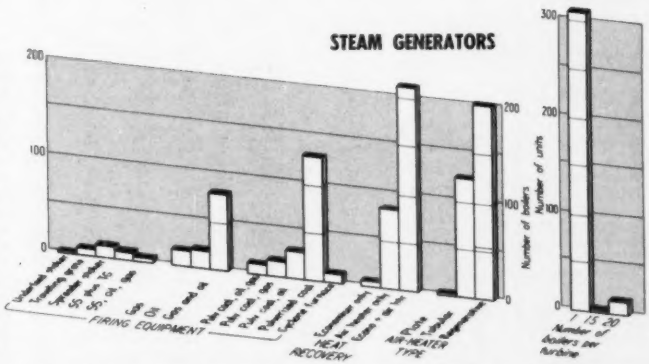
with less than 13,000,000 accounted for by straight regenerative units. Compare these figures with present installed steam capacity of about 55,000,000 kw, and it's easy to anticipate that during the next few years national average coal rate will decline rapidly.

Average size of reheat units equals 106,000 kw; average straight-regenerative unit is 45,000 kw. With few exceptions reheat units use temperatures 1000 F and above, and pressures of 1450 psig and higher.

Fig. 8 also shows that only seven topping units will be installed. This may indicate that most places where superposition can be profitably practiced have already been exploited.

The trend to one boiler per turbine is almost unanimous, as shown in Fig. 9. Tabulations that follow indicate that most frequent place for reserve equipment seems to be in the boiler-feed-pump lineup.

Of the units reported on the following pages, 86 will have boiler, turbine and electrical controls centralized; 34 are semi-outdoor design, 33 are completely outdoor arrangements with control rooms usually housed; 13 are reported with pressurized furnaces; 10 will use demineralizers instead of evaporators for make-up water treatment. The units with pressurized furnaces are usually equipped with axial forced-draft fans and no i-d fans.



9 Pulverized-coal firing still dominates utility practice with gas and oil where economical. Multiple-fuel firing used oftener. Note one-boiler-per-turbine dominance

For main-condenser air removal the steam-jet air ejector appears to be the favorite, but six units will use reciprocating pumps, ten will have rotary pumps, four both steam-jet ejectors and reciprocating pumps, and eight both ejectors and rotary pumps.

1952 Design Survey of Typical New

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant name	Consulting engineers	First operation, new units	Throttle pressure, psig	Steam temp, °F: Throttle	Steam temp, °F: Reheat	BOILERS: Number	Capacity, each, 1000 lb per hr	Manufacturer	Surface, 1000 sq ft: Boiler & W W	Surface, 1000 sq ft: Superheater	Surface, 1000 sq ft: Reheater
1000 PSIG AND ABOVE													
Public Service Electric and Gas Co	Kearny, N. J.	Kearny		12-52	2350	1100	1050	1	955	CE	34.7	93.9	14.8
				5-53	2350	1100	1050	1	955	CE	34.7	93.9	14.8
The Ohio Power Co	Reliel, Ohio	Muskingum River	Am Gas & Elec Service Corp	5-53	2000	1050	1050	1	1335	BW	37.4	91.4	.....
				7-53	2000	1050	1050	1	1335	BW	37.4	91.4	.....
Appalachian Electric Power Co	Glasgow, W. Va.	Kanawha River	Am Gas & Elec Service Corp	3-53	2000	1050	1050	1	1335	BW	39.7	91.4	.....
				1-53	2000	1050	1050	1	1335	BW	39.7	91.4	.....
Indiana & Michigan Electric Co	Lawrenceburg, Ind.	Tanners Creek	Am Gas & Elec Service Corp	9-52	2000	1050	1000	1	945	BW	46.1	62.8	.....
Ohio Edison Co	near Shadyside, Ohio	R E Burger	Commonwealth Associates, Inc	8-54	2000	1050	1000	1	1050	BW	18.9	70.7	21.4
	Niles, Ohio	Niles	Commonwealth Associates, Inc	6-53	1450	1000	1000	1	885	BW	25.7	52.9	29.3
				10-53	1450	1000	1000	1	885	BW	25.7	52.9	29.3
Narragansett Electric Co	Providence, R. I.	South Street	United Engrs & Constructors	12-53	2000	1000	.....	2	430	BW	9.64	19.5	.....
Philadelphia Electric Co	Philadelphia, Pa	Delaware		10-52	1800	1000	1000	1	875	BW	17.0	43.5	.....
				5-53	1800	1000	1000	1	875	BW	17.0	43.5	.....
	Cromby, Pa	Cromby		1953	1800	1000	1000	1	1050	BW	20.6	.....	.....
				1955	1800	1000	1000	1	1450	CE	61.6	140.5	.....
	Philadelphia, Pa	Richmond		9-50	1250	950	.....	2	800	CE	36.5	32.4	.....
Southern California Edison Co	Etiwanda, Calif	Etiwanda	Stone & Webster Engr Corp	12-52	1800	1000	1000	1	920	CE	27.3	75.3	.....
				12-52	1800	1000	1000	1	920	CE	27.3	75.3	.....
Commonwealth Edison Co	Stickney, Ill	Ridgeland	Sargent & Lundy	6-53	1800	1050	1000	1	1100	BW	27.3	72.0	16.2
				12-53	1800	1050	1000	1	1100	BW	27.3	72.0	16.2
Cleveland Electric Illuminating Co	Eastlake, Ohio	Eastlake		3-53	1800	1050	1000	3	875	CE	44.4	70.0	.....
Electric Energy, Inc	Joppa, Ill	Joppa	Ebasco Services Inc	9-52	1800	1050	1000	1	1200	CE	52.3	100.9	15.9
				11-52	1800	1050	1000	1	1200	CE	52.3	100.9	15.9
				1-53	1800	1050	1000	1	1200	CE	52.3	100.9	15.9
				3-53	1800	1050	1000	1	1200	CE	52.3	100.9	15.9
Consolidated Edison Co of N. Y. Inc[9]	New York, N. Y.	East River		12-53	1800	1000	1000	1	1450	FW	57.5	22.5	.....
Detroit Edison Co	East China Township, Mich	St. Clair		1-53	1800	1000	1000	1	1070	BW	26.3	60.7	45.1
Duke Power Co	Spencer, N. C.	Buck			1800	1000	1000	2	1070	BW	20.3	60.7	45.1
Wisconsin Electric Power Co	Milwaukee County, Wis.	Oak Creek		4-53	1800	1000	1000	2	900	CE	46.8	67.5	.....
				6-54	1800	1000	1000	1	795	CE	38.2	13.8	3.1
Pennsylvania Electric Co	Shawville, Pa.		Gilbert Associates, Inc	8-57	1800	1050	1000	2	994	BW	18.0	.....	21.0
	Erie, Pa.	Front Street[14]	Gilbert Associates, Inc	8-52	1250	950	.....	2	400	CE	19.2	12.9	.....
Rochester Gas & Electric Corp	Rochester, N. Y.	Russell	Gilbert Associates, Inc	8-53	1670	1000	1000	1	430	CE	20.7	.....	.....
Pacific Gas and Electric Corp	Antioch, Calif.	Contra Costa	Bechtel Corp	1953	1450	1000	1000	1	850	CE	26.1	75.3	13.0
				1953	1450	1000	1000	1	850	CE	26.1	75.3	13.0
	Moss Landing, Calif.	Moss Landing	Stone & Webster Engrg Corp	1952	1450	1000	1000	2	850	BW	.....	45.8	15.6
Consumers Power Co	Erie, Mich.	J R Whiting	Commonwealth Associates, Inc	6-52	1450	1000	1000	1	690	BW	14.8	52.0	.....
				12-52	1450	1000	1000	1	690	BW	14.8	52.0	.....
Niagara Mohawk Power Corp	near Albany, N. Y.	Albany		1953	1450	1000	1000	1	675	CE	32.8	42.3	.....
				1954	1450	1000	1000	1	675	CE	32.8	42.3	.....
Boston Edison Co	North Weymouth, Mass.	Edgar	Jackson & Moreland	1952	1450	1000	1000	1	580	CE	14.8	33.0	.....
				1954	1450	1000	1000	1	583	CE	14.8	33.0	.....
The Cincinnati Gas and Electric Co	near New Richmond, Ohio	Walter C Beckjord	Sargent & Lundy	6-53	1450	1000	1000	1	706	CE	36.0	70.3	.....
Virginia Electric and Power Co	Portsmouth, Va.	Portsmouth[10]	Stone & Webster Engrg Corp	2-53	1400	1000	1000	1	780	CE	33.2	46.0	.....
The Connecticut Light & Power Co	Uncasville, Conn.	Montville	United Engrs & Constructors	1954	1450	1000	1000	1	625	CE	27.0	.....	.....
Delaware Power & Light Co	Wilmington, Dela	Edge Moor	United Engrs & Constructors	1954	1450	1000	1000	1	600	CE	29.3	35.4	.....
Utah Power & Light Co	Salt Lake City, Utah	Gadsby	Bechtel Corp	10-52	1450	1000	1000	1	575	RS	35.2	46.5	.....
The Dayton Power & Light Co	Miamisburg, Ohio	O H Hutchings	Ebasco Services Inc	1-53	1450	1000	1000	1	430	CE	20.7	.....	.....
				8-53	1450	1000	1000	1	430	CE	20.7	.....	.....
Metropolitan Edison Co	Reading, Pa.	Titus	Gilbert Associates, Inc	1-53	1450	1000	1000	1	510	CE	29.3	64.5	9.3
Illinois Power Co	near Wood River, Ill.	Wood River	Sargent & Lundy	12-53	1450	1000	1000	1	700	CE	46.3	50.0	11.6
	near West La Salle, Ill.	Henneopin[14]	Sargent & Lundy	5-53	1450	1000	1000	1	525	CE	37.4	50.0	9.8
Houston Lighting & Power Co	Webster, Texas	Webster	Ebasco Services Inc	10-53	1450	1000	.....	1	950	BW	11.3	19.9	.....
				9-54	1450	1000	.....	1	950	BW	11.3	19.9	.....
	Houston, Texas	Greens Bayou	Ebasco Services Inc	10-52	1450	1000	.....	1	950	BW	11.3	19.9	.....
				4-53	1450	1000	.....	1	950	BW	11.3	19.9	.....
Cons Gas, Elec Lt & Pwr Co of Baltimore	Baltimore, Md.	Gould Street		11-52	1450	1050	.....	1	830	BW	15.9	33.3	.....
	Turner, Md.	Riverside		1953	1450	1050	.....	1	625	BW	11.7	24.1	.....
Wisconsin Power and Light Co	North Beloit, Wis	Rock River	Sargent & Lundy	8-53	1450	1000	1000	1	525	BW	11.2	75.4	.....
Potomac Electric Power Co	Benning, D. C.	Station A	Stone & Webster Engrg Corp	7-52	1450	1000	.....	1	544	CE	.....	.....	.....
Florida Power & Light Co	Cutler, Fla.	Cutler	Ebasco Services Inc	1952	1450	1000	1000	1	550	CE	26.1	35.0	8.2
	Riviera, Fla	Rivera	Ebasco Services Inc	.....	1250	950	.....	1	650	CE	27.0	.....	.....
Pennsylvania Power & Light Co	near Sunbury, Pa	Sunbury	Ebasco Services Inc	5-53	1450	1000	1000	1	1000	FW	49.2	20.7	37.5
	near Martins Creek, Pa		Ebasco Services Inc	3-54	1250	950	.....	1	1200	FW	72.1	19.3	.....
South Carolina Generating Co	Savannah River at Beech Island	Urquhart	Gilbert Associates, Inc	4-53	1450	1000	1010	2	510	CE	29.3	45.2	.....
South Carolina Electric & Gas Co	Charleston, S. C.	Hagood	Gilbert Associates, Inc	12-51	1250	950	.....	1	400	RS	24.0	.....	.....
Dallas Power & Light Co	Dallas, Texas	Parkdale	Ebasco Services Inc	1955	1450	1000	.....	1	950	BW	.....	.....	.....
				1-53	1250	950	.....	1	775	BW	.....	.....	.....
	Dallas, Texas	Dallas	Ebasco Services Inc	1-54	1250	950	.....	1	660	CE	.....	.....	.....
San Diego Gas & Electric Co	Carlsbad, Calif.	Encina	Pioneer Service & Engrg Co	10-54	1450	1000	1000	1	750	BW	.....	.....	.....
	San Diego, Calif.	Silver Gate	Pioneer Service & Engrg Co	10-52	1250	950	.....	1	575	BW	9.7	21.0	.....
Public Service Co of Indiana, Inc	near Terre Haute, Ind	Wabash River	Sargent & Lundy	12-52	1450	1000	1000	2	700	FW	32.7	11.6	21.4
	near Noblesville, Ind	Noblesville	Sargent & Lundy	9-50	850	950	.....	3	300	RS	28.5	11.8	.....
New York State Gas & Electric Corp	Dresden, N. Y.	Greenidge	Gilbert Associates, Inc	6-53	1450	1000	1000	1	665	CE	30.7	35.8	10.3
	Corning, N. Y.	Hickling	Gilbert Associates, Inc	5-52	850	950	.....	2	220	BW	23.1	0.9	.....
	Bainbridge, N. Y.	Jennison	Gilbert Associates, Inc	5-50	650	900	.....	2	200	CE	23.0	0.3	.....

Ag – Anthracite
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Ads – Admiralty, inhibited
Al/Br – Aluminum-brass
As/Ad – Antimony-Admiralty
As/Ad – Arsenical Admiralty
As/Al/B – Arsenical aluminum brass
AsCu – Arsenical copper
B/W – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc.
Con – Condenser deaeration
Cu/Ni – Copper nickel
Cy – Cyclone furnace
D – Damper
DB – Dry bottom
Du – Dual turbine and motor drive
FW – Foster Wheeler Corp
GE – General Electric Co
Hy – Hydraulic coupling
L – Lignite
La – Louvers
M – Motor drive
Ma – Magnetic coupling
Mo – Two motors per fan
O – Oil
P – Pulverized-fuel fired
PAd – Phosphorized Admiralty
Pj – Adjustable-pitch axial fan
Pl – Plate
R – Regulator
RB – Red brass
Re – Regenerative
RS – Riley Stoker Corp
S – Speed control
Sup – Superloy
SS – Spreader stoker
ST – Stag Up

Steam Central-Station Installations

Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	F-D FANS: Drive	F-D FANS: Air-flow control	I-D FANS: Drive	I-D FANS: Gas-flow control	Flue	FUEL: Type	FUEL: Heating value, Btu per lb	FUEL: Air-softening temperature, °F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Exhaustpressure, psia	TURBINES: No. bleed points	Full-load steam pressure, psig	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Type cooled	Total boiler capacity (all new units), 1000 lb	Total generator capacity (all new units), 1000 kw
52.0	21.8	ST	29.1	135.0	Re	M	Hy	M	D	P,O	G,O	13.2	———	SM	Hy	145	3600	GE	0.75	8	Con	70	1	AtBr	5820	479
52.0	21.8	ST	29.1	135.0	Re	M	Hy	M	D	P,O	G,O	13.2	———			145	3600	GE	0.75	8	Con	70	1	AtBr	6775	624
103.3	18.2	ST	13.3	246.6	Re	M	V	M	V	P	C	10.5	2000	3M	R	217.3[1]	3600[2]	GE	0.75	7	62	90	1	AsAd	1335	217.3
103.3	18.2	ST	13.3	246.6	Re	M	V	M	V	P	C	10.5	2000	3M	R	217.3[1]	3600[2]	GE	0.75	7	62	90	1	AsAd	2670	434.6
139.0	13.4	OB	16.7	246.6	Re	M	V	M	V	P	C	12.0	2800	3M	R	217.3[1]	3600[2]	GE	0.75	7	62	90	1	AsAd	2670	434.6
139.0	13.4	OB	16.7	246.6	Re	M	V	M	V	P	C	12.0	2800	3M	R	217.3[1]	3600[2]	GE	0.75	7	62	90	1	AsAd	2670	434.6
73.8	16.4	OB	16.7	140.7	Re	M	V	M	V	P	C	11.4	2300	3M	R	154[1]	3600[2]	GE	0.75	7	69	65	1	AsAd	1890	308
———	———	DB	18.1	427.0	Tu	M	V	M	V	P	C	11.0	2100	3M	R	135	3690	WE	1.25	8	———	75	2	Ad	3450	325
———	———	ST	0	377.3	Tu	M	V	—[3]	—[3]	Cy	C	11.0	2100	3M	R	106	3860	WE	1.0	6	———	66	2	Ad	885	106
———	———	ST	0	377.3	Tu	M	V	—[3]	—[3]	Cy	C	11.0	2100	3M	R	106	3600	WE	1.0	6	———	65	2	Ad	1770	212
29.6	18.0	OB	10.5	69.2	Re	M	V	M	D,Lo	P	C	13.9	2350	3M	Hy	50[4]	3600	WE	215	5	125	45	1	CuNi	2640	285
46.6	24.0	OB	19.7	363.0	Tu	M	V	M	D	P	C,O	13.3	2350	2M	R	125	3600	WE	0.5	7	Con	60	1	Ad	3875	311.6
46.6	24.0	OB	19.7	363.0	Tu	M	V	M	D	P	C,O	13.3	2350	2M	R	125	3600	GE	0.5	7	Con	60	1	Ad	4750	436.8
59.5	22.4	OB	———	———	Tu	M	V	M	D	P	C,O	13.3	2350	2M	R	150	3600	GE	0.5	6	Con	72	1	Ad	1050	150.0
125.5	15.0	OB	49.1	186.7	Re	M	———	M	D	P	C,O	13.3	2350	3M	R	200	3600	WE	0.5	6	Con	95	1	Ad	2500	350.0
60.0	15.5	OB	22.7	196.4	Re	M	V	M	V	P	C,O	13.3	2350	2T	R	165	1800	GE	0.5	5	Con	75	1	Ad	4840	467.0
35.0	———	———	19.7	45.6	Re	M	D,V	M	D	G,O	G,O	18.5	———	3M	R	100	3600	GE	1.0	6	18.8	80	2	AsCu	930	100
35.0	———	———	19.7	45.6	Re	M	D,V	M	D	G,O	G,O	18.5	———	3M	R	100	3600	GE	1.0	6	18.8	80	2	AsCu	1840	200
38.6	38.5	ST	14.3	413.0	Tu	M	V	M	V	Cy	C	10.0	2000	3M	R	150	3600[2]	WE	0.5	6	104.5	100	1	Ad	4020	450
38.6	38.5	ST	14.3	413.0	Tu	M	V	M	V	Cy	C	10.0	2000	3M	R	150	3600[2]	AC	0.5	6	104.5	100	1	Ad	5120	600
47.6	22.2	DB	23.5	198.2	Re	M	S,V,	M	S,V	P	C	11.4	2100	9M,1T	R	125[5]	3600	GE	0.5	6	45.1	60	1	RB	2625	375
114.0	14.5	OB	25.8	220.4	Re	M[7]	D,V	M[7]	D	P	C,O	11.0[6]	2100	3M	R	125	3600	GE	1.25	6	Con	90	2	Ad	1200	125
114.0	14.5	OB	25.8	220.4	Re	M[7]	D,V	M[7]	D	P	C,O	11.0[6]	2100	3M	R	125	3600	GE	1.25	6	Con	90	2	Ad	2400	250
114.0	14.5	OB	25.8	220.4	Re	M[7]	D,V	M[7]	D	P	C,O	11.0[6]	2100	3M	R	125	3600	GE	1.25	6	Con	90	2	Ad	3600	375
114.0	14.5	OB	25.8	220.4	Re	M[7]	D,V	M[7]	D	P	C,O	11.0[6]	2100	3M	R	125	3600	GE	1.25	6	Con	90	2	Ad	4800	500
108.0	17.2	DB	65.6	255.6	Re	M	V	M	D	P	C	13.3	2056	3M	R	140	3600	WE	0.5	7	138.0	125	1	AtBr	7670	600
25.3	19.0	DB	15.1	305.8	Re	M	Hy	M	Hy	P	C	11.6	2100	3M	Hy	125	3600[2]	GE	0.5	6	Con	76	1	Ad	3210	375
25.3	19.0	DB	15.1	305.8	Re	M	Hy	M	Hy	P	C	11.6	2100	6M	Hy	125[9]	3600[2]	AC	0.5	6	Con	76	1	Ad		
88.5	13.9	DB	16.3	187.2	Re	M	V	M	Hy	P	C	12.8	2100	3M	Hy	125[9]	3600	GE	0.75	6	90.0	75	2	Ad	4025	443
105.6	10.0	DB	34.0	284.4	Re	M	S	M	S	P	C	12.4	2050	2M	——	120	3600[2]	AC	0.5	6	Con	85	1	AsAd	3180	480
50.7	24.0	OB	7.2	256.0	Tu	M	V	M	V	P	C	13.0	2100	6M	R	100[4,9]	3600	GE	0.5	7	———	82.5	2	Sup	1788	215
25.5	19.6	DB	14.4	105.4	Re	M	V	M	V	P	C	11.3	2000	3M	R	50	3600	GE	0.5	5	100.0	37.5	2	Ad	1200	123.7
																10.7	3600	GE	275	...	100.0	...	...			
30.4	19.4	DB	5.4	129.0	Re	M	V	M	V	P	C	12.8	2100	3M	2R,1Hy	50	3600	GE	0.5	6	———	32.5	2	Ad	1260	140
41.0	27.0	———	18.2	91.2	Re	M	D,V	M	D	O,G	O,G	18.5	———	3M	———	100	3600	GE	0.75	6	100	57.5	2	AtBr	4550	500
41.0	27.0	———	18.2	91.2	Re	M	D,V	M	D	O,G	O,G	18.5	———	3M	———	100	3600	WE	0.75	6	100	57.5	2	AtBr		
54.9	21.0	———	4.4	169.4	Re	M	D,V	M	D	O,G	O,G	18.5	———	6M	———	100[9]	3600	GE	0.75	6	90	57.5	2	AtBr	4550	500
52.3	18.0	DB	14.3	227.0	Tu	M	Hy	M	Hy	P	C	11.0	2100	2M	Hy	85	3600	GE	0.75	6	Con	47.5	2	PAd	1380	170
52.3	18.0	DB	14.3	227.0	Tu	M	Hy	M	Hy	P	C	11.0	2100	2M	Hy	85	3600	GE	0.75	6	Con	47.5	2	PAd		
58.0	15.9	DB	15.4	99.3	Re	M	V	M	S	P	C	13.0	2050	3M	S,Hy	80	3600	GE	0.5	7	90.0	50.0	1	Ad	2025	240
58.0	15.9	DB	15.4	99.3	Re	M	V	M	S	P	C	13.0	2050	3M	S,Hy	80	3600	GE	0.5	7	90.0	50.0	1	Ad	2700	320
42.0	17.3	DB	13.3	157.8	Re	M	V	M	S	P	C,O	13.9	2400	2M	——	61.3	3600	WE	0.75	5	35.0	45.0	1	AtBr	2961	320.3
42.0	17.3	DB	13.3	157.8	Re	M	V	M	S	P	C,O	13.9	2400	2M	——	81.3	3600	WE	0.75	5	35.0	45.0	1	AtBr	3544	401.6
64.2	14.7	DB	9.5	192.6	Re	M	D,V	M	D,Ha	P	C	13.0	2500	3M	Hy	100[11]	3600	GE	0.75	5	70.4	55.0	2	AsCu	1412	200
41.0	26.0	DB	18.6	126.4	Re	M	V	M	V	P	C,O	13.0	2300	3M	Hy	90[11]	3400	GE	0.75	5	75.0	65.0	2	AtBr	750	90
47.0	15.8	DB	13.6	71.7	Re	M	V	M	Hy	P	C	12.5	2100	3M	R	75	3400	GE	0.75	6	Con	60.0	2	AtBr	———	180
———	15.6	DB	22.1	144.8	Tu	M	D	M	S,D	P	C,O	13.2	2000	3M	Hy	75	3600	GE	1.25	6	20.0	40.0	1	Ad	1800	287
53.5	14.7	DB	9.0	136.6	Re	M	D,V	M	D,V	P	C,O[12]	12.9	1950	2M	Hy	75	3600	WE	0.75	5	21.0	37.5	1	AsAd	1195	120
30.4	19.5	DB	5.6	93.2	Re	M	D,V	M	D,Ha	P	C	13.0	2200	1M	R	60[11]	3600	GE	0.75	6	40.0	45.0	2	Ad	2390	300
30.4	19.5	DB	5.6	93.2	Re	M	D,V	M	D,Ha	P	C	13.0	2200	1M	R	60[11]	3600	GE	0.75	6	40.0	45.0	2	Ad	2820	360
44.6	15.6	DB	10.5	204.4	Re	M	V	Mp	V	P	C,O	13.0	2000	2M	Hy	75[11]	3600	GE	0.5	5	25.0	42.5	2	PAd	1530	225
68.2	14.5	ST	16.1	186.9	Tu	M	V	M	Hy	P	C,G	10.7	1960	2M	Hy	90[11]	3400	GE	0.75	5	78.0	70.0	2	AsCu	2050	250
49.2	14.4	ST	9.0	172.5	Tu	M	V	—[3]	Hy	P	C	10.4	1960	1M,1T	Hy	60[13]	3400	GE	0.5	5	90.0	50.0	2	Ad	525	60
45.0	24.6	———	22.9	153.5	Tu	M	V	—[3]	———	G,O	G,O	1060[15]	———	3M	R	80	3600	GE	1.75	4	120.0	80.0	2	PAd	950	80
45.0	24.6	———	22.9	153.5	Tu	M	V	—[3]	———	G,O	G,O	1060[15]	———	3M	R	80	3600	GE	1.75	4	120.0	80.0	2	PAd	1900	160
45.0	24.6	———	22.2	153.5	Tu	M	V	—[3]	———	G,O	G,O	1060[15]	———	3M	R	80[11]	3600	WE	1.75	4	120.0	80.0	2	AsCu	2250	270
45.0	24.6	———	22.2	153.5	Tu	M	V	—[3]	———	G,O	G,O	1060[15]	———	3M	R	80[11]	3600	WE	1.75	4	120.0	80.0	2	AsCu	3200	360
46.5	22.2	DB	13.5	115.8	Re	M	V	M	S	P	C,O	12.5[24]	1900	3M	R	60[25]	3600	GE	0.5	5	94.0	77.0	2	AsAlB	1700	172
43.0	18.1	DB	13.2	109.6	Re	M	V	M	Hy	P	C,O	12.5[24]	1900	3M	R	60[26]	3600	GE	0.5	5	86.0	55.0	2	AsAlB	2900	330
18.0	———	ST	19.0	193.0	Tu	M	V	M	D	Cy	C	10.4	2000	2M	Hy	60	3600	AC	0.5	5	100.0	50.0	2	AsAd	525	60
55.4	14.4	DB	23.7	122.5	Tu	M	D	M	Ha	P	C,O	13.0	2100	3M	Hy	75	3600	GE	400	...	———	...	...	...	4750	280
40.0	19.2	———	14.8	93.8	Re	M	D	M	D	O	O	18.3	———	3M	———	50	3600	GE	1.25	6	Con	50.0[16]	2	AtBr	———	155
44.0	———	———	33.5	44.7	Re	M	D	M	D	O	O	18.3	———	3M	———	60[11]	3400	GE	1.25	5	Con	60.0	2	AtBr	———	125
95.7	14.6	DB	49.0	235.6	Re	M	V	M	Ha	P	C,A	13.7[17]	2000	3M	R	125	3400	WE	0.75	5	69.5	65.0	2	Ad	3400	375
105.0	14.2	DB	47.5	238.0	Re	M	V	M	V	P	C	13.7	2000	3M	R	125	3600	GE	0.75	5	63.7	60.0	2	Ad	1200	125
44.6	15.6	DB	10.5	204.4	Re	M	V	M	V	P	C,O	13.0	2000	2M	R	75[9]	3600	GE	1.25	6	25.0	45.0	2	PAd	1020	130
28.0	17.8	OB	6.2	64.0	Re	M	Ha	M	Ha	O	O	18.6	———	2M	R	40[11]	3600	WE	1.00	5	115.0	35.0	2	AtBr	860	85
———	———	———	———	———	Tu	M	V	—[3]	—[3]	G,O	G,O	1000[15]	———	3M	R	80	3600	WE	———	...	———	...	...	...	1725	187
———	———	———	———	———	Tu	M	V	—[3]	—[3]	G,O	G,O	1000[15]	———	3M	R	65.6	3600	GE	1.75	4	———	60.0	2	AsCu	775	87
———	———	———	———	———	Tu	M	V	M	D	G,O	G,O	1000[15]	———	2M	R	60[11]	3600	GE	1.25	4	75.0	55.0	2	AsCu	2425	237
25.0	28.7	DB	12.6	121.0	Re	M	D,Hy	M	D,Hy	G,O	G,O	18.0	———	3M	———	90	3600	GE	———	5	———	70.0	2	AtBr	750	80
———	15.2	DB	32.1	222.0	Re	M[7]	V	M[7]	D,Hy	P	C	11.0	2090	4M	Hy	90[9]	3600	WE	0.75	5	70.3	70.0	2	AsAd	1400	180
22.5	14.9	DB	———	117.1	Re	M	V	M	D,Hy	P	C	11.4	2100	3M,1T	——	40[9]	3600	WE	0.75	4	51.3	40.0	2	Ad	900	90
57.6	15.0	DB	21.0	85.2	Re	M	V	M	V	P	C	13.1	2400	3M	2Hy	75	3600	GE	0.55	7	71.0	50.0	1	AsAd	1680	180
12.5	22.4	———	5.2	25.2	Tu	M	V	M	Ha	TG(742)	An	11.0	2900	2M	R	40	3600	GE	0.75	5	25.7	42.5	2	AsAd	770	85
9.7	27.0	———	10.4	12.0	Tu	M	V	M	Ha	TG(672)	An	11.3	2800	M,T,Da	R	30[11]	3600	GE	0.75	4	39.0	23.0	2	Ad	800	60

T – Turbine drive
TG – Traveling-grate stoker
Tu – Tubular
V – Vane control
WB – William Gros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WW – Waterwalls
(672) – Stoker grate area, sq ft

1 – Gross capacity
2 – M-g 3600 rpm; I-g 1800 rpm
3 – No I-d fan, pressurized furnace
4 – Feedheating turbine on main shaft
5 – 3 units installed
6 – 11,000 to 13,000 Btu per lb
7 – 2 fans per boiler
8 – Astoria station (1950 survey) changed to 2 GE units

9 – 2 units reheated
10 – Formerly Gilsonite
11 – Preferred-standard unit
12 – Petroleum pitch alternate fuel
13 – Gross capability 83,000 kw
14 – Revised, originally listed 1950 survey
15 – Btu per cu ft
16 – Tube shell, 25,005 sq ft each
17 – Anthracite HHV – 12,540 Btu per lb
18 – Revised, originally listed 1949 survey
19 – Water-filled ash pit
20 – Jointly owned station
21 – River anthracite

22 – Two shell, 18,000 sq ft each
23 – 1st unit, supplies steam, electricity and water to adjacent industrial plant
24 – 12,500 to 13,900 Btu per lb
25 – Gross capability 100,000 kw
26 – Gross capability 80,000 kw

1952 Design Survey of Typical New

Compiled by B G A Skotdal, Associate Editor

Company	Location	Plant name	Consulting engineers	First operation new units	Throttle pressure, psig	Steam temp, °F		BOILERS					
											Surface, 1000 sq ft		
						Throttle	Reheat	Boilers	Capacity, each, 1000 lb per hr	Manufacturer	Boiler & W W	Superheater	Reheater
Gulf States Utilities Co	Baton Rouge, La.	Louisiana	Stone & Webster Engrg Corp	1-54	1500	950	.....	3	566	CE	18.4	16.0	.....
				6-53	850	900	.....	1	600	CE	26.2	6.8	.....
				10-51	600	750	.....	.....	.....	.....	.....	.....	.....
	Scott, La.	Nelson	Stone & Webster Engrg Corp	5-54	1300	950	.....	1	600	CE	.....	.....	.....
	Beaumont, Texas	Neches	Stone & Webster Engrg Corp	6-57	850	900	.....	1	600	CE	19.3	14.0	.....
Alabama Power Co	Gorgas, Ala.	Gorgas	Southern Services, Inc	7-52	1250	950	.....	1	975	BW	17.6	34.2	.....
Mississippi Power & Light Co	Cleveland, Miss.	Delta	Ebasco Services Inc	1-53	1250	1000	.....	1	850	FW	11.9	29.4	.....
				6-53	1250	1000	.....	1	850	FW	11.9	29.4	.....
The Hartford Electric Light Co	Middletown, Conn.	Laurel	Stone & Webster Engrg Corp	1953	1250	950	.....	1	600	BW	11.8	.....	.....
Carolina Power & Light Co	Goldsboro, N. C.	Goldsboro	Ebasco Services Inc	5-51	1250	950	.....	1	650	BW	13.4	25.9	.....
Iowa Power & Light Co	Des Moines, Iowa	Des Moines No. 2.	Black & Veatch	4-53	1250	950	.....	1	625	BW	13.2	26.3	.....
	Council Bluffs, Iowa	Council Bluffs	Black & Veatch	12-53	1250	950	.....	1	425	BW	8.9	14.9	.....
Columbus & Southern Ohio Electric Co	Athens, Ohio	E M Poston	Ebasco Services Inc	3-52	1250	950	.....	1	625	FW	17.4	40.4	.....
Indianapolis Power & Light Co	North of Martinsville, Ind.	White River	Gibbs & Hill, Inc	10-52	1250	950	.....	1	600	CE	25.8	19.7	.....
The Scranton Electric Co	West Pittston, Pa	Stanton	Gilbert Associates, Inc	6-53	1250	950	.....	1	400	FW	23.8	14.5	.....
Kansas Gas & Electric Co	Oatville, Kan.	Murray Gill	Ebasco Services Inc	4-52	1250	950	.....	1	425	FW	16.7	15.9	.....
				10-53	1250	950	.....	1	625	FW	.....	.....	.....
Southern Indiana Gas & Electric Co	Newburgh, Ind.	F B Culley	Commonwealth Associates, Inc	1954	1250	950	.....	1	380	BW	.....	.....	.....
Union Electric Co of Missouri	St Louis County, Mo.	Meramec[18]	.....	12-52	1250	950	950	1	935	CE	44.5	48.8	12.1
				3-53[14]	1250	950	.....	1	450	BW	8.2	16.9	.....
Florida Power Corp	Oldsmar, Fla.	Higgins	Burns & Roe, Inc	11-53[14]	1250	950	.....	1	450	CE	17.5	.....	.....
	Avon Park, Fla.	Avon Park	Burns & Roe, Inc	11-52[14]	1250	950	.....	1	450	CE	17.5	.....	.....
	Ellaville, Fla.	Suwanee River	Black & Veatch	1-53	850	900	.....	1	350	CE	36.6	.....	.....
Texas Electric Service Co	Colorado City, Texas	Morgan Creek	Ebasco Services Inc	5-52	850	900	.....	1	450	CE	24.6	7.5	.....
				5-54	1250	950	.....	1	650	CE	.....	.....	.....
	Fort Worth, Texas	Tarrant County	Ebasco Services Inc	3-54	1250	950	.....	1	1100	BW	.....	.....	.....
Texas Power & Light Co	Kiesel, Texas	Lake Creek	Ebasco Services Inc	1953	1250	950	.....	1	775	CE	31.9	20.9	.....
	Trinidad, Texas	Trinidad	Ebasco Services Inc	12-49	850	900	.....	2	350	BW	25.9	13.3	.....
Southwestern Public Service Co	Amherst, Texas	Plant "X"	.....	6-53	1250	950	.....	1	1000	CE	30.7	.....	.....
	Sunray, Texas	Moore County	.....	1954	850	900	.....	1	500	CE	34.5	.....	.....
	Eddy County, N. M.	Eddy County	.....	1954	850	900	.....	1	500	CE	34.5	.....	.....
	Carlsbad, N. M.	Carlsbad	Stearns-Roger Mfg Co	9-52	600	825	.....	2	100	BW	.....	.....	.....
The Tucson Gas, Electric Light & Power Co	Tucson, Ariz.	Station No. 3	Sanderson & Porter	5-53	1050	900	.....	1	300	BW	.....	.....	.....
				3-54	1000	900	.....	1	560	BW	.....	.....	.....
BELOW 1000 PSIG													
Public Service Co of Oklahoma	Washita, Okla.	Southwestern	Sargent & Lundy	9-52	900	900	.....	2	335	BW	21.5	.....	.....
				1-54	900	900	.....	1	664	BW	36.3	.....	.....
Western Massachusetts Electric Co	West Springfield, Mass.	West Springfield	Stone & Webster Engrg Corp	11-49[18]	875	925	.....	1	450	CE	15.6	14.9	.....
Louisville Gas & Electric Co	Louisville, Ky.	Paddys Run	Pioneer Service & Engrg Co	11-52	875	525	.....	1	450	CE	15.6	14.9	.....
Public Service Co of Colorado	Denver, Colo.	Lacombe	.....	10-52	850	900	.....	1	640	FW	31.5	24.0	.....
				1953	850	900	.....	1	725	BW	48.5	18.6	.....
The Potomac Edison Co	Albright, W. Va.	Albright[20]	Sanderson & Porter	9-52	850	900	.....	1	700	RS	61.0	23.5	.....
Monongahela Power Co	Albright, W. Va.	Albright[20]	Sanderson & Porter	7-52	850	900	.....	1	700	RS	61.0	23.5	.....
Georgia Power Co	McManus, Ga.	McManus	Southern Services, Inc	9-52	850	900	.....	1	425	BW	7.8	10.4	.....
Mississippi Power Co	Meridian, Miss.	Sweatt	Southern Services, Inc	5-53	850	900	.....	1	425	BW	7.9	10.0	.....
Pennsylvania Water & Power Co	Holtwood, Pa.	Holtwood	Ebasco Services Inc	1954	850	900	.....	1	700	FW	47.4	19.4	.....
Tampa Electric Co	Tampa, Fla.	Hookers Point	Stone & Webster Engrg Corp	11-53	850	900	.....	1	440	BW	.....	.....	.....
The Empire District Electric Co	Riverton, Kan.	Riverton	Black & Veatch	11-53	850	950	.....	1	400	CE	31.6	13.7	.....
Central Illinois Electric & Gas Co.	Rockford, Ill.	Sabrooke	Stone & Webster Engrg Corp	6-52	850	900	.....	1	300	FW	.....	.....	.....
California Electric Power Co	Highgrove, Calif.	Highgrove	The Fluor Corp, Ltd	5-52	850	900	.....	2	320	CE	26.9	.....	.....
Gulf Power Co	Chattahoochee, Fla.	River Junction	Southern Services, Inc.	10-52	850	900	.....	1	425	BW	7.8	10.4	.....
				10-53	850	900	.....	1	425	BW	7.8	10.4	.....
	Pensacola, Fla.	Pensacola	Southern Services, Inc	7-52	850	900	.....	1	325	RS	27.1	14.5	.....
El Paso Electric Co.	El Paso, Tex.	Rio Grande	Stone & Webster Engrg Corp	11-54	850	900	.....	1	335	BW	.....	.....	.....
Savannah Electric & Power Co	Savannah, Ga.	Riverside	Stone & Webster Engrg Corp	8-54	850	900	.....	1	200	CE	.....	.....	.....
Central Louisiana Electric Co	St. Landry, La.	Coughlin	Sargent & Lundy	7-52	850	900	.....	1	200	BW	14.9	5.4	.....
	Baldwin, La.	Teche	Sargent & Lundy	5-53	850	900	.....	1	200	BW	.....	.....	.....
Southwestern Gas & Electric Co	Easton, Texas	Knox Lee	Sargent & Lundy	7-52	850	900	.....	1	300	BW	21.5	7.8	.....
	Lone Star, Texas	Lone Star	Sargent & Lundy	12-53	850	900	.....	1	425	BW	26.1	14.9	.....
Rockland Light & Power Co	Tomkins Cove, N. Y.	Hudson	Burns & Roe, Inc	7-51	850	900	.....	1	280	BW	18.7	7.6	.....
				1951	850	900	.....	1	310	BW	20.2	20.1	.....
Central Maine Power Co	Wiscasset, Me.			1952	850	900	.....	1	310	BW	20.2	20.1	.....
Central Power & Light Co	Victoria, Texas	Victoria	Sargent & Lundy	8-52	850	900	.....	1	300	BW	20.5	8.1	.....
The Kansas Power & Light Co	Lawrence, Kan.	Lawrence[14]	Black & Veatch	9-52	850	900	.....	1	375	CE	19.2	11.6	.....
The United Illuminating Co	New Haven, Conn.	English	Westcott & Mapes	1953	850	900	.....	1	320	BW	11.4	12.3	.....
BELOW 700 PSIG													
Atlantic City Electric Co	near Gibbstown, N. J.	Greenwich[23]	Burns & Roe, Inc	9-52	650	825	.....	2	230	CE	27.5	.....	.....
Lake Superior District Power Co	Ashland, Wis.	Bay Front	Sargent & Lundy	4-52	625	900	.....	1	200	BW	21.1	5.9	.....
Southern Utah Power Co	Cedar City, Utah	.....	Stone & Webster Engrg Corp	6-52	600	825	.....	1	70	BW	.....	.....	.....
Interstate Power Co	Dubuque, Iowa	Dubuque	Sargent & Lundy	10-52	600	900	.....	1	200	RS	22.1	7.0	.....
Central Kansas Power Co	Hill City, Kan.	Ross Beach	Black & Veatch	12-52	600	825	.....	1	130	BW	10.2	.....	.....
Fitchburg Gas & Electric Light Co	Fitchburg, Mass.	Fitchburg	Chas T Main, Inc	7-52	600	825	.....	1	150	CE	18.7	4.0	.....
Northern States Power Co	Minot, N. D.	Bison	Pioneer Service & Engrg Co	11-52	400	750	.....	1	75	WB	8.6	2.0	.....
Montana-Dakota Utilities Co	Sheridan, Wyo.	Acme	Stearns-Roger Mfg Co	7-52	400	750	.....	1	60	BW	10.0	.....	.....

Aa – Anthracite
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Adi – Admiralty, inhibited
Albr – Aluminum-brass
AnAd – Antimony-Admiralty
AsAd – Arsenical Admiralty
AsAlB – Arsenical aluminum brass
AsCo – Arsenical copper
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc.
Con – Condenser deneration
CuNi – Copper nickel
Cy – Cyclone furnace
D – Damper
DB – Dry bottom
Du – Dual turbine and motor drive
FW – Foster Wheeler Corp
GE – General Electric Co
Hy – Hydraulic coupling
L – Lignite
Lo – Louvers
M – Motor drive
Ma – Magnetic coupling
Mp – Two motors per fan
O – Oil
P – Pulverized-fuel fired
PAd – Phosphorized Admiralty
Pi – Adjustable-pitch axial fan
Pl – Plate
R – Regulator
RB – Red brass
Rn – Regenerative
RS – Riley Stoker Corp
S – Speed control
Sup – Superdry
SS – Spreader stoker
ST – Slag tap

Steam Central-Station Installations

Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	F-D FANS: Drive	F-D FANS: Air-flow control	I-D FANS: Drive	I-D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Air-softening temperature, °F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Extraction pressures, psia	TURBINES: No. bleed points	Fabricated steam-line pressure, psig	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity (last new unit), 1000 lb	Total generator capacity (all new units), 1000 kw
31.0	26.8	DB	15.6	68.0	Re	M	V	M	D	G,O	G,O	1015[15]	.....	SM	R	40[9]	3600	WE	155	.....	.....	.....	.....	.....	6650	355
28.0	30.0	DB	15.7	55.6	Re	M	V	M	D	G,O	G,O	1015[15]	.....	2M	R	60[11]	3600	WE	.....	4	.....	50.0	2	Ad	9950	263.5
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	3600	GE	135	0	.....	.....	.....	.....	4350	203.5
36.0	21.7	.....	20.4	61.6	Re	M	O	.....	.....	G,O	G,O	1060[15]	.....	2M	R	60[11]	3600	WE	.....	5	.....	50.0	2	Ad	600	60
28.0	30.0	DB	15.6	55.6	Pl	M	O	M	O	G,O	G,O	1060[15]	.....	2M	R	60[11]	3600	WE	0.75	4	50	55.0	2	Ad	2800	245
58.9	19.4	.....	34.2	289.2	Re	M	Hy	M	Hy	P	C	.....	.....	3M	Hy	100	3600	WE	1.0	5	60.3	32.5	2	AsAd	3350	328
44.4	24.8	DB	31.7	164.4	Re	M	O,V	.....	.....	G,O	G,O	1062[15]	.....	3M	H	105	3600	GE	.....	5	Con	.....	2	.....	950	105
44.4	24.8	DB	31.7	164.4	Re	M	O,V	.....	.....	G,O	G,O	1062[15]	.....	3M	R	105	3600	GE	.....	5	Con	.....	2	.....	1750	210
43.9	16.4	DB	21.6	70.2	Re	M	V	M	Hy	P	C	13.4	2500	3M	Hy	60[11]	3600	GE	0.75	5	53.6	47.5	2	Ad	600	60
53.6	14.8	DB	33.6	76.2	Re	M	V	M	D	P	C	13.8	2100	2M	R	60[11]	3600	WE	0.75	5	80.0	60.0	2	AsCu	650	66
53.6	14.7	DB	35.7	154.6	Re	M	V	M	Ma	P	C,G	9.2	1753	3M	R	60[11]	3600	WE	0.75	5	24.0	55	2	AsCu	2400	190
30.0	17.6	DB	18.7	114.2	Re	M	V	M	Ma	P	C,G	11.4	1894	2M	R	40[11]	3600	GE	0.75	5	24.0	37.5	2	AsCu	425	40
57.6	14.0	DB	27.7	197.6	Tu	M	O,V	M	O,V	P	C	11.5	2200	3M	R	60[11]	3600	WE	0.75	5	50.0	55.0	2	AsCu	1475	140
40.0	18.5	DB	22.5	69.0	Re	Mp	V	Mp	V	P	C	11.0	1950	3M	R	60[11]	3600	GE	0.75	5	65.0	40.0	2	AsAd	1800	180
65.2	8.5	—[19]	14.4	125.8	Re	M	V	M	D	P	An	11.0	2600	3M	1Hy	40[11]	3600	GE	0.5	5	68.0	35.0	2	Ad	1240	140
26.9	.....	.....	9.5	48.7	Re	M	V	M	D,V	G,O	G,O	1000[15]	.....	2M	R	40[11]	3600	GE	1.25	4	Con	40.0	2	Ad	425	40
.....	.....	.....	.....	.....	Re	M	V	.....	D,V	G,O	G,O	1000[15]	.....	3M	R	60[11]	3600	WE	1.25	4	.....	55.0	2	Ad	1050	100
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	P	C	11.0	2000	.....	.....	40[11]	3600	AC	.....	.....	.....	.....	.....	.....	380	40
96.0	12.8	DB	35.4	269.6	Tu	M	V	M	V	P	C,G	10.7	2100	3M	R	125	3600	WE	1.25	7	60.0	90.0	2	.....	925	125
26.0	18.5	DB	11.1	98.7	Tu	M	O	M	O	O	O	18.4	.....	2M	R	40[11]	3600	GE	0.75	5	74.6	32.5	1	CuNi	900	80
24.5	19.3	DB	16.1	128.0	Re	M	O	M	O	O	O	18.5	.....	3M	R	40[11]	3600	GE	0.75	5	76.4	32.5	1	CuNi	1350	120
24.5	19.3	DB	16.1	128.0	Tu	M	O	M	O	O	O	18.5	.....	3M	R	40[11]	3600	GE	0.75	5	54.5	32.5	1	Ad	600	55
26.5	13.7	.....	.....	16.6	Re	M	O	M	O	O	O	18.5	.....	2M	R	30[11]	3600	AC	0.75	5	32.5	25.0	2	Ad	350	30
22.0	20.5	DB	8	66.6	Tu	M	O	M	O	G,O	G,O	1050[15]	.....	2M	R	40[11]	3600	GE	1.25	4	Con	37.5	2	AsCu	890	84
.....	.....	DB	.....	.....	Tu	M	O	M_2	O_3	G,O	G,O	1050[15]	.....	3M	R	60[11]	3600	GE	.....	4	Con	60.0	2	AsCu	1540	150
.....	.....	DB	.....	.....	Tu	M	O	.....	.....	G,O	G,O	1050[15]	.....	3M	R	110	3600	GE	1.75	5	Con	75.0	2	AsCu	1100	110
41.0	26.1	DB	32.3	94.8	Tu	M	.....	M	.....	G	G	1000[15]	.....	3M	R	65.6	3600	GE	1.75	5	.....	60.0	2	AsCu	775	65.6
22.2	21.3	DB	.....	55.6	Re	M	V	M	D	G	G	1057[15]	.....	3M	R	60[11]	3600	GE	1.25	4	75.0	60.0	2	Ad	2300	161.2
57.5	22.7	DB	38.4	94.9	Re	M	D,V	M	D,V	G,O	G,O	1000[15]	.....	3M	S,Hy	80	3600	GE	1.75	5	63.5	85.0	2	AsAd	1500	120
22.0	29.0	DB	0	.....	Re	M	D,V	M	D,V	G,O	G,O	1000[15]	.....	2M	S,Hy	40	3600	GE	1.75	5	75.0	42.5	2	AsAd	880	66.3
22.0	29.0	DB	0	.....	Re	M	D,V	M	D,V	G,O	G,O	1000[15]	.....	2M	S,Hy	40	3600	WE	1.75	5	75.0	42.5	2	AsAd	500	40
.....	.....	.....	0	.....	Re	M	D,V	M_2	O_3	G,O	G,O	.....	.....	2M	R	18.8	3600	GE	1.00	4	75.0	22.5	2	AsAd	500	53.2
13.2	30.4	.....	0	53.3	Tu	Mp	V	.....	O_3	G,O	G,O	1073[15]	.....	2M	R	25	3600	WE	1.25	3	.....	20.0	2	Ad	600	55
27.9	28.2	.....	0	73.2	Tu	Mp	V	.....	O_3	G,O	G,O	1073[15]	.....	2M	R	50	3600	WE	1.25	3	.....	45.0	2	Ad	1150	105
13.2	31.2	DB	.....	53.3	Tu	M	O	.....	.....	G,O	G,O	1000[15]	.....	2M	R	80[11]	3600	WE	0.75	4	80.0	60.0	2	CuNi	670	80
32.2	26.6	DB	.....	.....	Tu	M	O	.....	.....	G,O	G,O	1000[15]	.....	1M	R	80[11]	3600	WE	0.75	4	80.0	60.0	2	CuNi	1334	160
29.2	19.4	DB	13.3	94.4	Re	M	Hy	M	Hy	P,O	C	12.5	.....	1M,1T	.....	40	3600	GE	0.75	4	41.0	35.0	2	Ad	800	60
29.2	19.4	DB	13.3	94.4	Re	M	Hy	M	Hy	P,O	C	12.5	.....	2M	.....	40	3600	GE	0.75	4	41.0	35.0	2	Ad	800	80
45.1	18.0	DB	19.0	29.6	Re	M	Ma	M	Ma	P	C	11.3	1900	3M	R	60	3600	WE	0.75	4	65	55.0	2	Ad	3110	300
.....	.....	.....	.....	.....	Tu	.....	.....	.....	.....	P	C,G	.....	.....	.....	.....	60[11]	3600	WE	0.75	.....	.....	.....	.....	.....	.....	.....
44.2	19.6	DB	0	124.2	Re	M_2	V	M_2	V	P	C	.....	.....	1M	R	60[11]	3600	GE	1.25	4	88	50.0	2	Ad	1400	120
44.2	19.6	DB	0	124.2	Re	M^2	V	M^2	D	P	C	.....	2200	2M	.....	60[11]	3600	GE	0.75	4	91.5	50.0	2	Ad	700	60
22.3	23.2	DB	18.3	37.3	Re	M	Hy	M	Hy	O	O	18.4	.....	2M	R	40[11]	3600	AC	1.0	5	52.0	32.5	2	AlBr	425	40
22.1	24.5	DB	18.3	37.3	Re	M	V	M	V	G	G	10.2[15]	.....	2M	R	40[11]	3600	GE	1.25	5	90.0	32.5	2	Ad	850	80
96.0	9.7	DB	13.1	220.0	Re	M	V	M	V	P	An^{21}	10.0	2740	3M	R	60[11]	3600	GE	0.75	4	88.0	55.0	2	AsAd	1630	96
21.4	27.3	.....	.....	63.2	Re	M	O	M	O	O	O	18.0	.....	3M	R	40[11]	3600	GE	.....	5	.....	42.5	2	CuNi	1390	130
35.0	15.4	DB	12.5	85.4	Re	M	V	M	D	P	C,O,G	12.0	2050	2M	R	40[11]	3600	WE	0.75	5	20	40.0	2	AsAd	1765	151
17.2	24.1	.....	19.4	32.9	Tu	M	V	M	D,S	SS(546)	C,G	10.6	1950	2M	.....	30[11]	3600	GE	.....	5	.....	25.0	2	Ad	505	50
13.1	.....	DB	0	34.5	Re	M	V	M	V	G,O	G,O	18.5	.....	2M	R	30[9,11]	3600	GE	1.0	5	62.6	27.5	2	AsCu	640	60
22.3	23.3	DB	18.3	37.3	Re	M	Hy	M	Hy	P	C	13.1	2200	2M	R	40[11]	3600	GE	0.66	5	52.0	32.5	2	AsAd	425	40
22.3	23.3	DB	18.3	37.3	Re	M	Hy	M	Hy	P	C	13.1	2200	2M	R	40[11]	3600	GE	0.66	5	52.0	32.5	2	AsAd	850	80
19.5	20.9	.....	.....	58.6	Re	Mp	V	Mp	D	G,O	G,O	1000[15]	.....	2M	R	30[11]	3600	WE	1.0	5	49.4	25.0	2	AlBr	785	75
14.4	32.2	DB	.....	61.2	Re	M	O,V	M	O,V	G,O	G,O	974[15]	.....	2M	R	30[11]	3600	GE	.....	4	.....	25.0	2	Ad	2410	120
9.3	28.2	.....	.....	27.7	Re	M	V	M_2	V_3	O	O	18.3	.....	2M	R	25[11]	3600	WE	.....	4	.....	16.0	2	Ad	860	72.5
8.7	31.5	.....	0	31.6	Tu	M	Pl	$_3$	$_3$	G	G	1096[15]	.....	2M	R	25[11]	3600	GE	0.75	4	24.7	19.0	2	Adl	500	45
.....	.....	.....	.....	.....	Tu	M	O	$_3$	$_3$	G	G	1020[15]	.....	2M	R	20[11]	3600	GE	0.75	4	57.0	19.0	2	.....	.....	.....
13.2	31.2	.....	0	53.3	Tu	M	V	$_3$	$_3$	G,O	G,O	.....	.....	1M	R	30[11]	3600	WE	0.75	4	.....	25.0	1	AsCu	600	60
19.8	28.3	.....	.....	101.6	Tu	M	.....	$_3$	$_3$	G	G	1025[15]	.....	2M	R	40[11]	3600	GE	1.25	4	63.0	32.5	1	AsAd	425	40
16.3	15.9	DB	0.9	40.7	Tu	M	V	M	Hy	P,G,O	P,G,O	13.4	2050	2M	R	20[11]	3600	GE	0.75	4	56.0	18.7	1	Ad	400	40
.....	.....	.....	.....	.....	Re	.....	.....	.....	.....	P,O	C,O	.....	.....	.....	.....	30[11]	3600	GE	0.75	.....	.....	.....	.....	.....	310	60
.....	.....	.....	.....	.....	Re	.....	.....	.....	.....	P,O	C,O	.....	.....	.....	.....	30[11]	3600	GE	0.75	.....	.....	.....	.....	.....	620	60
13.1	31.2	.....	0	53.3	Tu	M	Pl	$_3$	$_3$	G	G	1000[15]	.....	1M,1T	R	30[11]	3600	WE	2.0	4	65.0	30.0	2	AsAd	300	30
20.2	23.5	DB	0	55.8	Re	.....	.....	M	Ma	P	C,O,G	11.5	1900	1M,1T	R	30[11]	3600	WE	0.75	5	.....	36.0[22]	2	AsCu	495	40
22.7	17.1	DB	10.3	82.6	Re	Mp	V	Mp	V	P	C,O	13.7	2300	2M,1T	R	30	3600	GE	1.25	5	72.0	27.5	1	AlBr	1708	135
.....	.....	.....	.....	77.1	Tu	T	S	T	.....	P	C	.....	.....	1M,1T	.....	10	3600	GE	190	.....	.....	.....	.....	.....	460	10
11.6	22.4	.....	7.2	16.6	Tu	M	V	M	D,Mo	SS(387)	C	13.5	2300	1M	.....	20	3600	GE	0.5	4	15.0	13.0	2	Ad	450	45
3.6	26.6	.....	2.9	0	.....	M	V	M	D,Hy	SS, TG	C	10.5	2100	2M	R	5	3600	WE	.....	2	.....	4.5	2	Adl	105	7.5
16.0	16.2	.....	.....	45.0	Tu	M	V	M	Mo	P	C	10.5	1950	2M	.....	25	3600	GE	0.5	4	90.7	22.5	2	PAd	510	50
9.0	28.5	DB	0	28.3	Tu	Mp	V	Mp	V	G,O	G,O	1096[15]	.....	1M,1T	R,S	11.5[11]	3600	GE	0.75	4	20.0	12.7	2	Ad	130	11.5
8.7	28.5	DB	.....	34.6	Re	M	V	M	D	P	C,O	13.6	2200	1T	.....	7.1	3600	GE	715	.....	.....	.....	.....	.....	615.0	38.1
4.2	22.4	.....	.....	5.8	Tu	M	V	M	D	TG,SS	L	6.6	2043	1M	.....	6.0	3600	GE	0.75	3	64.1	5.2	3	Ad	150	10
3.2	.....	DB	0	5.7	Tu	M	V	M	V	SS	L	9.2	.....	2M	R	5.0	3600	GE	0.75	3	.....	5.0	2	Ad	193	12

T – Turbine drive
TG – Traveling-grate stoker
Tu – Tubular
V – Vane control
WB – William Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WH – Waterwalls
(622) – Stoker grate area, sq ft

1 – Gross capacity
2 – Hi-p 3600 rpm; I-p 1485 rpm
3 – No I-d fan, pressurized furnace
4 – Feedheating turbine on main shaft
5 – 3 units installed
6 – 11,000 to 13,000 Btu per lb
7 – 2 fans per boiler
8 – Astoria station (1950 survey) changed to 2 GE units

9 – 2 units installed
10 – Formerly Gilbreton
11 – Preferred-standard unit
12 – Petroleum pitch alternate fuel
13 – Gross capability 83,000 kw
14 – Revised, originally listed 1950 survey
15 – Btu per cu ft

16 – Twin shell, 25,000 sq ft each
17 – Anthracite HHV - 12,340 Btu per lb
18 – Revised, originally listed 1949 survey
19 – Water-tilted ash pit
20 – Jointly owned station
21 – River anthracite

22 – Twin shell, 18,000 sq ft each
23 – 1st unit, supplies steam, electricity and water to adjacent industrial plant
24 – 12,500 to 13,900 Btu per lb
25 – Gross capability 108,000 kw
26 – Gross capability 90,000 kw

1952 Design Survey: Typical Municipal,

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant name	Consulting engineers	First operation, year built	Throttle pressure, psig	Steam temp., °F: Throttle	Steam temp., °F: Reheat	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Surface, 1000 sq ft: Boiler & air htr	BOILERS: Superheater	BOILERS: Reheater
Tennessee Valley Authority	Pride, Ala	Colbert		8-54	1800	1050	1050	1	1280				
					1800	1050	1050	1	1280				
				12-52	1800	1000	1000	1	1000	BW	21.0	68.5	29.5
	Chiles, Ky	Shawnee			1800	1000	1000	1	1000	BW	21.0	68.5	29.5
					1800	1000	1000	1	1000	BW	21.0	68.5	29.5
					1800	1000	1000	1	1000	BW	21.0	68.5	29.5
					1800	1000	1000	1	850	BW	18.9	64.5	25.8
					1800	1000	1000	1	850	BW	18.9	64.5	25.8
	Bridgeport, Ala	Widow's Creek		5-52	1450	1000		1	1000	BW	18.3	35.2	
					1450	1000		1	1000	BW	18.3	35.2	
					1450	1000		1	1000	BW	18.3	35.2	
					1450	1000		1	1000	BW	18.3	35.2	
				5-53	1800	1000	1000	1	1000	CE	44.5	94.8	20.4
	Kingston, Tenn	Kingston			1800	1000	1000	1	1000	CE	44.5	94.8	20.4
					1800	1000	1000	1	1000	CE	44.5	94.8	20.4
					1800	1000	1000	1	1000	CE	44.5	94.8	20.4
				10-51	1450	1000		1	1000	CE	39.1	40.8	
					1450	1000		1	1000	CE	39.1	40.8	
					1450	1000		1	1000	CE	39.1	40.8	
	New Johnsonville, Tenn	Johnsonville			1450	1000		1	1000	CE	39.1	40.8	
					1450	1000		1	1000	CE	39.1	40.8	
					1450	1000		1	1000	CE	39.1	40.8	
					1450	1000		1	1000	CE	39.1	40.8	
City of Los Angeles	Los Angeles, Calif	Valley		1953	1450	1000		1	850	BW	16.2	32.7	
Omaha Public Power District	Omaha, Nebr	North Omaha		1953	1450	1000		1	850	BW	16.2	32.7	
Omaha Public Power District	Omaha, Nebr	Jones St		12-53	1450	1000	1000	1	575	CE	28.8	50.0	
Pasadena Municipal Light & Power Dept	Pasadena, Calif	Broadway	O. H. Hedrick	7-51	1250	950		1	400	BW	6.6	17.8	
				10-53	1250	950		1	425	CE	22.5		
Nebraska Public Power System	Bellevue, Nebr	Kramer	Sargent & Lundy	1949	1250	950		3	220	BW			
				12-51	1250	950		1	330	BW	11.5	16.2	
City of Lansing	Lansing, Mich	Moores Park	Burns & Roe, Inc	3-54	1250	950		1	340	BW	8.0	16.2	
		Ottawa Street	Burns & Roe, Inc	1-51	825	900		1	275	BW	8.6	13.2	
				1-51	825	900		1	275	BW	8.6	13.2	
City Public Service Board	San Antonio, Texas	Leon Creek	Gibbs & Hill, Inc	6-53	1250	955		1	615	BW	14.2		
Board of Public Utilities	Kansas City, Kan		Burns & McDonnell Engrg Co	3-56	850	900		1	300	BW	21.2	2.6	
City of Worthington	Worthington, Minn		Pfeifer & Shultz	12-53	1025	910		1	400	BW	26.7	11.2	
Salt River Power District	Tempe, Ariz	Kyrene	Bechtel Corp	10-51	975	900		1	135	BW			
				6-52	850	950		1	350	CE	17.9	8.5	
The Hydroelectric Power Comm. of Ontario	Toronto, Ontario	R. L. Hearn[9]	Stone & Webster Engrg Co	11-51	850	900		4	850	BWG			
Imperial Irrigation District	El Centro, Calif	El Centro	Gibbs & Hill, Inc	8-52	850	900		1	300	BW	21.5	6.9	
City of Glendale	Glendale, Calif	Glendale	O. H. Hedrick	12-52	850	900		1	215	BW	14.8	5.5	
East Kentucky Rural Electric Coop	Ford, Kentucky		Burns & McDonnell Engrg Co	7-53	850	900		2	220	FW	20.2	8.7	
City of Colorado Springs	Colorado Springs, Colo	North	Lutz & May	10-52	850	900		2	160	SP	11.9	7.2	
City of Burbank	Burbank, Calif		C. A. Heinze	1953	850	900		1	275	BW	20.2	7.2	
Northwest Electric Power Cooperative	Missouri City, Mo		Lutz & May	1953	850	900		2	220	FW	20.4	8.7	
Taunton Municipal Lighting Plant	Taunton, Mass	Weir	Pierce Consulting Engrg Co	12-51	850	825		1	100	BW	10.2		
Western Electric Cooperative	Anadarko, Okla		Laramore & Douglass	12-52	850	900		2	160	SP			
City of Burlington	Burlington, Vt		Pierce Consulting Engrg Co	1-54	850	825		3	100				
Northeast Missouri Electric Power Coop	South River Station, Mo	South River	Stanley Engrg Co	4-52	625	835		2	100	EM	11.0	2.6	
Consumer's Public Power District	Scottsbluff, Nebr	Bluffs	Stearns-Roger Mfg Co	3-52	600	825		1	100	BW	8.1	3.1	
Borough of Wallingford	Wallingford, Conn	Borough Electric Works	Burns & McDonnell Engrg Co	9-52	600	825		3	90	EM	11.7	3.4	
Corn Belt Power Cooperative	Humbolt, Iowa		Stanley Engrg Co	11-51	600	825		1	125	RS			
City Water & Light Plant	Jonesboro, Ark		Burns & McDonnell Engrg Co	1-53	600	825		1	110	BW	6.3		
Northern Michigan Electric Coop, Inc	Boyne City, Mich	Advance	Stanley Engrg Co	9-52	600	825		2	90	SP	9.6	3.4	
Utility Board of Key West	Key West, Fla		R. W. Beck & Associates	9-52	600	825		2	66	RS	7.6	1.3	
				12-52	600	825		1	200	FW	18.6		
New Brunswick Electric Power Commission	New Castle Creek, N. B.	Grand Lake No. 2		12-51	410	675		1	150	CE	19.7		
Boro of Vineland	Vineland, N. J.		Gilbert Associates, Inc	1952	600	825		1	100	BW			
City of Piqua	Piqua, Ohio		W. I. Barrows & Associates	12-51	450	750		1	150	CE	19.3		
Board of Public Works	Poplar Bluff, Mo		Rogers & Schmidt	1-52	450	750		1	55	EC			
Board of Public Works	South Haven, Mich		Hamilton, Weeber & Ward	9-54	450	750		1	80	WI	10.2	2.0	
Marshall Municipal Utilities	Marshall, Minn		Pfeifer & Schultz	10-52	450	750		1	65	WB			
Borough of Chambersburg	Chambersburg, Pa		A. C. Wood Associates, Inc	1951	440	700		2	60	EM	7.5		
Municipal Power & Light Dept	Greenfield, Ohio		W. I. Barrows & Associates	4-52	425	725		1	35	BW			
City of Lamar Electric Dept	Lamar, Colo	Lamar	Lutz & May	5-52	400	825		1	80	UI	3.9	2.7	
City of Regina Light & Power Dept	Regina, Sask			5-51	400	825		1	165	FW	17.3		
City of Portland	Portland, Ind		Hageman & Tengleton	5-52	400	750		1	75	WI	9.1		
Municipal Commission of Herkimer	Herkimer, N. Y.		G. B. Panero	11-50	400	750		1	50	BW			
City of Greenwood	Greenwood, Miss			1951	400	750							
City of Luverne	Luverne, Minn		Pfeifer & Schultz	11-51	400			1	54	WB			
City of Windom	Windom, Minn		Pfeifer & Schultz	3-51	300	680							
City of Mountain Iron	Mountain Iron, Minn		Pfeifer & Schultz	12-51	200			1	25	EM			

AC – Atlas-Chalmers Mfg Co
Aj – Admiralty
Ajli – Admiralty, inhibited
Ajlb – Admiralty brass
Alb – Aluminum bronze
Alb – Aluminum brass

Ashd – Arsenical admiralty
AsCu – Arsenical copper
B – Bronze
BW – Babcock & Wilcox Co
BWG – Babcock & Wilcox, Goldie-McCulloch

C – Cast, bituminous
CE – Combustion Engineering-Superheater, Inc
CP – C A Parsons
Cu – Copper
D – Dumper

DD – Dry bottom
DL – DeLaval Steam Turbine Co
EC – Erie City Iron Works
EI – Elliott Co
EM – Edge Moor Iron Works, Inc
FW – Foster Wheeler Corp

G – Natural gas
GE – General Electric Co
Hy – Hydraulic coupling
L – Lignite
M – Motor drive
Ma – Magnetic coupling

Federal and Cooperative Installations

Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air-heater surface per boiler, 1000 sq ft	Air-heater type	F–D FANS: Drive	F–D FANS: Air-flow control	I–D FANS: Drive	I–D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, Btu per lb	FUEL: Ash-softening temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Backpressure, psia	TURBINES: No. bleed points	Full-load superheater pressure, psig	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity, last new units, 1000 lb	Total generator capacity, last new units, 1000 kw
—	—	—	—	—	Re	M	—	M	—	P	C	11.5	1950	3M	Hy	180	3600	GE	1.0	8	900	95.0	1	Ad	1280	180
—	—	—	—	—	Re	M	—	M	—	P	C	11.5	1950	3M	Hy	180	3600	GE	1.0	8	900	95.0	1	Ad	2560	360
72.6	20.1	DB	—	—	Re	M	D	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	70.0	1	Ad	1000	135
72.6	20.1	DB	—	—	Re	M	D	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	70.0	1	Ad	2000	270
72.6	20.1	DB	—	—	Re	M	D	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	70.0	1	Ad	3000	405
72.6	20.1	DB	—	—	Re	M	D	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	70.0	1	Ad	4000	540
53.0	21.4	DB	0	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	7	864	60.0	1	Ad	4850	562.5
53.0	21.4	DB	0	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	7	864	60.0	1	Ad	5700	675
55.2	21.5	DB	24.7	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	6	864	70.0	1	Ad	1000	112.5
55.2	21.5	DB	24.7	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	6	864	70.0	1	Ad	2000	225
55.2	21.5	DB	24.7	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	6	864	70.0	1	Ad	3000	337.5
55.2	21.5	DB	24.7	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	112.5	3600	GE	1.0	6	864	70.0	1	Ad	4000	450
93.0	14.5	DB	14.6	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	60.0	1	Ad	1000	135
93.0	14.5	DB	14.6	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	60.0	1	Ad	2000	270
93.0	14.5	DB	14.6	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	60.0	1	Ad	3000	405
93.0	14.5	DB	14.6	—	Re	M	V	M	D	P	C	11.5	1950	3M	Hy	135	3600	WE	1.0	7	715	60.0	1	Ad	4000	540
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	1800	GE	1.0	6	62.7	70.0	1	Ad	1000	112.5
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	1800	GE	1.0	6	62.7	70.0	1	Ad	2000	225
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	1800	GE	1.0	6	62.7	70.0	1	Ad	3000	337.5
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	1800	GE	1.0	6	62.7	70.0	1	Ad	4000	450
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	3600	WE	1.0	6	62.7	70.0	1	Ad	5000	562.5
79.5	15.1	DB	34.7	—	Re	M	V	M	D	P	C	11.2	1950	3M	Hy	112.5	3600	WE	1.0	6	62.7	70.0	1	Ad	6000	675
49.0	21.4	DB	17.9	160	Tu	M	D,V,Hy	M	D,Hy	O,G	O,G	18.8	—	3M	Hy	100	3600	WE	0.75	5	105.0	55.0	1	Ad	850	100
49.0	21.4	DB	17.9	160	Tu	M	D,V,Hy	M	D,Hy	O,G	O,G	18.8	—	3M	Hy	100	3600	WE	0.75	5	105.0	55.0	1	Ad	1700	200
49.2	14.0	DB	9.0	69.2	Re	M	V	M	Ha	P,G	C,G	11.4	1900	2M	Hy	60	3600	GE	0.5	5	65.0	55.0	2	AsCu	575	60
33.0	15.0	DB	9.2	86.5	Re	M	Hy	M	Hy	P,G	C,G	11.4	1900	1M,1T	Hy	40[4]	3600	GE	0.5	5	60.0	35.0	2	AsCu	2100	173
20.0	25.9	—	11.7	41.5	Re	Mp	D,V	Mp	D,V	O,G	O,G	18.2	—	3M	R	40[4]	3600	AC	0.75	5	64.0	35.0	2	AsCu	1375	120
—	—	DB	—	—	—	—	—	—	—	—	—	—	—	—	—	30[2]	3600	GE	1.0	4	20.0	27.5	1	AsCu	680	80
—	16.4	DB	4.8	68.4	Re	M	V	M	Hy	P,G	C,G	12.0	—	4M,1T	R	30	3600	GE	1.0	4	28.0	27.5	1	AsCu	990	90
22.0	21.0	DB	8.2	43.2	Tu	M	Hy	M	Hy	P	C	12.9	2490	2M	R	40[4]	3600	AC	0.75	5	56.0	35.0	2	Ad	930	96.5
15.7	20.5	ST	11.6	31.2	Tu	M	Hy	M	Hy	P	C	12.9	2490	2M	R	25	3600	AC	0.5	6	25.0	23.0	2	Ad	1000	56.5
15.7	20.5	ST	11.6	31.2	Tu	M	Hy	M	Hy	P	C	12.9	2490	2M	R	25	3600	AC	0.5	6	25.0	23.0	2	Ad	1275	81.5
28.6	28.0	—	19.1	125.0	Tu	M[6]	—	—	—	G,O	G,O	—	—	3M	R	60[4]	3600	WE	1.25	5	55.0	55.0	2	Ad	1215	120
13.2	31.5	DB	—	49.3	Tu	M	V	M	V	G,O	G,O	1080[7]	—	1M,1T	R	30[4]	3600	WE	0.75	4	55.0	27.5	2	Ad		
30.0	16.4	—	0	68.3	Re	M	V	Mp	D	P,G	C,G	11.8	1900	3M	—	40	3600	—	—	5	—	40.0	2	Ad	440	48
7.2	—	DB	—	32.8	Tu	T	D	M	D	P,O,G	C,O,G	—	—	—	—	10	3600	WE	—	3	—	12.0	2	Ad	280	16.5
18.7	22.8	DB	0	57.2	Re	M	D	M	V	O,G	O,G	—	—	2M	R	30[4]	3600	GE	1.5	4	30.9	27.0	2	AsCu	350	30
69.6	15.4	DB	9.5	165.2	R	M	D	M	D	P	C	13.6	2100	12M	R	80[3]	1800	CP	—	5	—	60.0	2	Ad	3400	320
11.1	34.3	DB	—	40.1	Re	M	V	M	V	O,G	O,G	1100[7]	—	2M	R	30[4]	3600	AC	1.0	5	—	27.5	2	PAd	560	50
8.7	33.2	DB	0	25.3	Re	Mp	V	Mp	V	O,G	O,G	18.7	—	2M	R	20	3600	GE	1.0	4	155.0	17.0	2	AsCu	815	60
15.7	18.0	DB	0	49.8	Re	M	V	Mp	D	P	C	12.5	2400	6M	—	20[2]	3600	EI	—	4	—	18.0	2	Ad	440	40
—	18.8	DB	0	28.8	Tu	M	V	Mp	S,D	G	G	1000[7]	—	2M,2T	R	15[2,4]	3600	GE	0.75	4	24.0	15.0	2	Ad	320	30
14.5	24.6	DB	0	34.5	Re	M	S,V	M	S,D,V	O,G	O,G	18.4	—	2M	R	30[4]	3600	AC	0.88	5	27.5	27.5	2	PAd	900	70
15.7	18.9	DB	0	—	Tu	M	D	Mp	D	P,O,G	C,O,G	11.2	1995	2M,2T	R	20[2,4]	3600	WE	0.75	4	27.0	22.5	2	Ad	440	40
6.1	20.0	DB	1.3	9.7	Tu	M	V	M	V	O	O	18.3	—	1M	—	7.5	3600	GE	0.75	3	60.0	10.0	2	AsCu	560	29
—	—	—	—	—	Tu	M	V	M	V	G	G	—	—	4M	R	15[2,4]	3600	EI	0.75	4	60.0	16.0	—	Ad	320	30
5.0	—	DB	—	—	Tu	M	V	M	V	SS(250)	C	13.6	2100	3M,1T	—	10[1]	3600	GE	0.75	3	—	8.0	2	Ad	300	30
5.0	27.0	DB	2.6	7.1	Tu	M	V	M,Mp	O,Ma	SS(182)	C,O,G	12.4	2360	4M	R	7.5[2]	3600	GE	1.0	3	70.0	8.0	1	PAd	180	15
5.2	24.6	DB	0	17.0	Tu	M	V	M	D	G,O	G,O	1020[7]	—	2M	R	7.5	3600	GE	0.75	3	18	9.0	2	AsAd	205	15
4.0	24.1	—	3.8	9.8	Tu	M	S,V	M	S,O	SS(180)	C,O	13.2	2900	3M,1T	R	7.5[1]	3600	DL	1.0	3	25.0	10.0	2	Ad	270	22.5
6.5	25.2	DB	3.3	10.0	Tu	Mp	D	Mp	D	SS(265)	C,G	11.0	2050	2M	R	11.5	3600	EI	1.0	4	—	14.0	2	PAd	305	26.5
3.3	42.0	DB	0	14.7	Tu	M	V	M	D	G	G	1027[7]	—	1M,1MT	R	9.4	3600	WE	1.0	—	60.0	9.0	2	Mu	270	22.5
5.5	21.8	ST	0	—	Re	M	D	M	Hy	P	C	12.0	2100	3M	R	7.5[2]	3600	DL	0.75	3	95.0	6.5	1	Ad	180	15
3.3	26.0	—	0	6.5	Tu	M	V	Mp	V	O	O	18.9	—	3M,1T	R	5.0[2]	3600	AC	1.0	3	30.0	6.7	2	AlB	130	10
16.2	15.8	—	0	31.1	Tu	M	V	M	Hy	P	C	11.2	1980	2M	—	18.75	3600	CP	1.0	3	30.0	14.0	1	Adlr	350	28
—	18.5	—	—	11.5	Tu	—	V	—	D	P	C	11.2	1950	2M	—	6.25[2]	3600	CP	1.0	2	30.0	—	1	Adlr		
—	—	—	—	—	Tu	MT	V	MT	V	SS	C	13.9	—	3M,1T,1MT	R	7.5	3600	EI	1.0	5	22.0	—	—	—	480	26
7.2	29.9	—	2.5	6.4	Tu	MT	V	MT	S,D	TG(460)	C	11.0	2150	4M,2T	R,S	12.5	3800	EI	0.75	3	15.0	12.0	2	AsCu	450	33
3.6	19.6	DB	0	0	—	M	D	MT	D	SS(160)	C,G	11.6	2250	1M,1T	R	1.8	3600	GE	—	—	—	3.8	2	—	125	7.3
3.7	30.5	DB	4.4	—	—	M	—	M	—	UF	C	13.4	2900	1M,1T	—	7.5	—	—	—	—	—	—	—	—	228	17.5
—	—	DB	0	—	Tu	M	V	M	V	P,O	C,O	12.5	—	1M,1T	R	3.0	3600	EI	1.0	2	15.0	2.7	2	Mu	70	7.0
—	—	—	0	7.1	Tu	M	D	T	D	P	C	13.8	2400	1M,1T	R	5.0[2]	3600	WE	1.0	2	20.0	—	1	—	200	11
1.3	—	—	—	—	—	MT	D	M	D	TG(122.5)	C	12.4	2000	1M,1T	R,	1.8	3600	GE	—	—	—	3.8	1	—	67	3.5
4.4	—	DB	0	9.5	Tu	Mp	S,V	Mp	S,V	G,O	G,O	1000[7]	—	1M,1T	R	5.0	3600	EI	0.75	2	—	5.0	3	Ad	135	11
8.6	26.6	DB	0	28.4	Tu	MT	V	MT	S,Hy	O	O	18.3	—	1M	R	20	3600	CP	0.5	2	15.0	28.3	2	Ad	695	55
—	29.5	—	6.2	0	—	M	—	M	D	SS	C	11.3	2100	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	0	—	—	M	D	M	D	SS	C	14.0	2700	1M,1T	R	3.0	3600	EI	0.5	1	15.0	—	2	B	90	5.5
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.0	3600	WE	0.75	1	20.0	6.0	2	Cu	230	20.5
—	25.6	DB	—	4.6	Tu	T	D	M	D	O	O	—	—	1M,1T	R	—	3600	WE	—	2	—	4.5	2	Ad	90	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.0	3600	EI	—	1	—	3.5	2	Ad	48	3.9
—	—	DB	—	—	Tu	M	D	M	D	SS(67.2)	C	—	—	1M,1MT	R	0.75	3600	AC	—	1	—	1.6	2	Mu	47	1.1

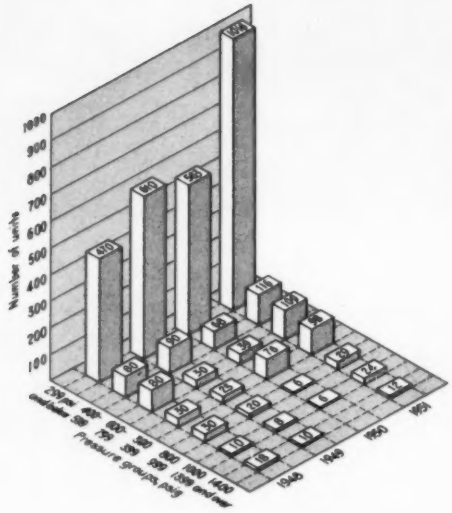
Mi – Murray Iron Works
Mp – Two motors per fan
MT – One motor, one turbine per fan
Mu – Mumford metal
O – Oil
P – Pulverized-fuel fired
PAd – Phosphorized admiralty

R – Regenerative
Re – Regenerative
RS – Riley Stoker Corp
S – Spreader stoker
SS – Springfield Boiler Co
SV – Spreader stoker
ST – Sing Sing

T – Turbine drive
TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
WB – The Wm Bros Boiler & Mfg Co

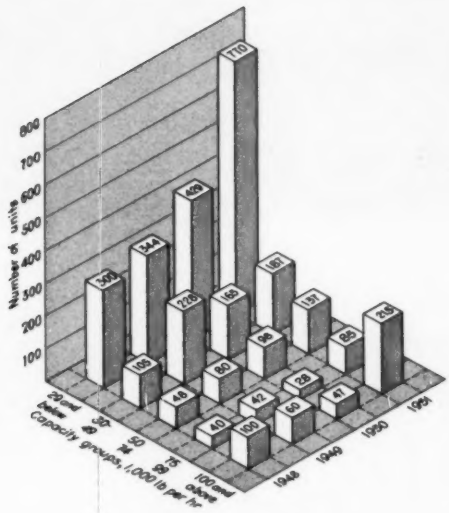
WE – Westinghouse Electric Corp
Wi – Wickes Boiler Co
WW – Wintermills
(250) – Stoker grate area, sq ft
[1] – 3 units installed
[2] – 2 units installed
[3] – 4 units installed

[4] – Preferred standard
[5] – Pressurized furnace
[6] – Includes 1000-kw diesel
[7] – Btu per cu ft
[8] – 2 I-d fans, no I-d fan
— – Revised, originally listed in 1950 survey



PRESSURE DIVISIONS

Low-pressure boilers still lead in number of units. To prevent overlap of bars, pressure-scale order has been altered



CAPACITY GROUPS

Mobilization expansion in heavy industry shows up in increased use of large boiler units — 100,000 lb per hr and above

Industry Boosts Steam Capacity

Industrial and institutional plants throughout the country are busy getting their powerhouses in order against any eventuality. That's the prime impression gained from POWER's current survey, covering the last quarter of 1950 and the first three of 1951. Other gleanings: (1) some shifts in fuel choices (2) increased attention to problems of air and stream pollution.

Big question mark is effect of controls on industrial and institutional power expansion. Best guess seems that threat of controls, particularly CMP (POWER, Oct, Nov, 1951), stimulated some early order placing. Then operation of the program tended to slow down deliveries, at least for customers unable to demonstrate need for priorities assistance.

Pressure Divisions. Just as in other years, the greatest number of industrial boilers fall into the 299-psi-and-below class and are of less than 30,000-lb-per-hr steaming capacity.[1] Slightly over 70% are below 300 psi, with about 25% in the range from 300 to 799 psi. The reason is obvious: the majority of boilers going into industrial and institutional plants are for heating and process service. Relatively few in number (around 5%) are for power generation as well.

Pressures in the industrial field are inching up (see tables, pp 90-93). The highly reliable performance of the large-capacity high-pressure single-boiler-turbine installations in central stations have influenced big industrials to reap some of the same economies. And the trend for electric power demand to increase faster than steam demand in many industries gives another boost to higher pressures and temperatures.

Capacity Ranges. While the majority of industrial and institutional boilers develop under 30,000 lb per hr, the fewer large-capacity units far outproduce them. As many as 215 units for 100,000 lb per hr and over were ordered during the survey period. Their total output alone runs very close to the total of the 29,000-lb-per-hr-and-under group.

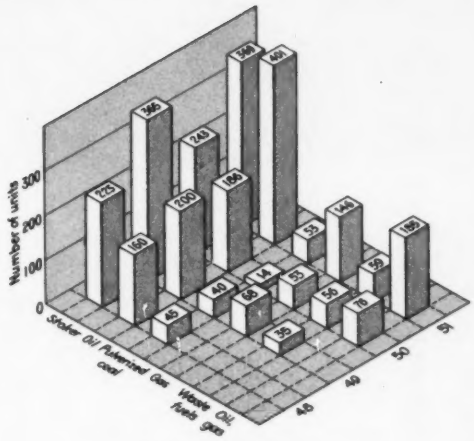
Fuels and Firing. While concern continues to be expressed about supplies of residual fuels and availability of natural gas in some areas, these fuels remain the choice of many small-plant owners. The suitability of oil and gas for "packaged" installations undoubtedly outweighs any worry over possible curtailment of supply.

Coal still remains plentiful. While movement over the country's railroads may be a little slower than when there was no pinch on cars, availability of coal is not a real problem. Table II shows a significant rise in choice of stokers and pulverized-fuel systems over 1950 survey figures. For boilers of 50,000 lb per hr and over, use of stoker firing has doubled and pulverized-coal firing quadrupled.

Many plants reporting spreader-stoker firing express an intent to burn waste-fuel products of one sort or another. In some instances, this results from the growing problem of waste-product disposal. It also reflects the fact that higher costs for conventional fuels put an economic premium on using waste fuels where possible.

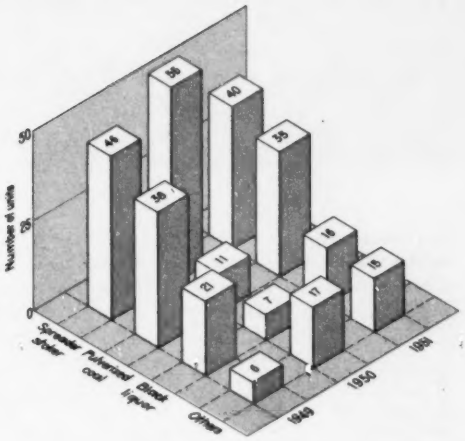
Pollution Problems. Combined effect of increasing stream-pollution restrictions and tighter air-pollution ordinances hits many industries. For example, waste sulfite liquor has long presented a disposal problem for the pulp and paper industry. Research and development of individual manufacturers and groups such as the Sulfite Mfrs League of Wisconsin (POWER,

[1]Tables I and II on facing page, and pressure, capacity and firing-method charts above are based on known orders for the survey period. Dust-collector chart is derived from information from reporting plants, as tabulated on the following pages.



FIRING METHODS

Despite threatened sectional pinches, smaller plants still show preference for oil and gas, larger stress flexibility



DUST COLLECTION

Dust collectors have become an accepted part of industry's boiler plant. Use of waste fuels contributes to this trend

TABLE I — PRESSURE DIVISIONS

Pressure, psi	STOKER				OIL				PULVERIZED COAL				GAS		Gas and Oil		Coal, Oil and Gas		Waste Fuels	
	1948	1949	1950	1951	1948	1949	1950	1951	1948	1949	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951
299 and below	187	201	186	306	138	129	138	340	6	5	2	8	31	86	62	133	—	—	15	18
300-399	1	6	9	8	6	2	37	64	4	2	1	5	9	14	10	9	—	—	—	1
400-599	34	18	17	20	7	9	14	10	17	12	4	10	1	17	4	16	2	4	10	23
600-799	4	7	7	19	8	4	2	4	22	7	1	14	8	17	5	20	2	1	8	14
800 and above	8	1	3	3	5	4	—	1	15	4	2	11	—	11	2	8	1	1	3	15

TABLE II — CAPACITY DIVISIONS

Capacity, M lb per hr	STOKER				OIL				PULVERIZED COAL				GAS		Gas and Oil		Coal, Oil and Gas		Waste Fuels	
	1948	1949	1950	1951	1948	1949	1950	1951	1948	1949	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951
29 and below	108	205	144	183	110	92	119	316	2	1	0	1	25	77	55	86	0	0	14	7
30-49	47	90	42	70	26	72	37	46	7	4	0	—	16	20	5	25	0	0	12	4
50-74	25	28	45	54	17	21	26	17	9	10	0	7	10	15	5	25	0	1	10	8
75-100	18	13	4	17	0	11	1	10	14	4	3	7	0	5	4	17	0	1	10	6
Above 100	21	13	7	45	13	12	3	12	38	21	10	38	2	29	7	32	4	3	10	34

Feb 1951, p 100) look to burning sulfite liquor as an economical and nuisance-free disposal method. And in the steel industry, improved cleaning and firing methods make blast-furnace gas a base-load fuel (POWER, Sept 1951, p 96).

Dust Collectors. Working toward complying fully with today's air-pollution ordinances and tougher ones that may be in the cards, industry is digging deep for answers on cinder and flyash removal. Chart above shows use of dust collectors with various methods of firing, while tables on following pages show general type of collectors — electrostatic or mechanical — installed by reporting plants.

There seems to be little doubt that a further reason impelling many small-plant owners to choose oil or gas firing lies in the dust problem. To them, possible limitations on fuel availability weigh less than extra capital outlays for dust-collecting equipment to make coal-firing fully acceptable where strict ordinances are in force.

1952 Design Survey: Typical Industrial and

Compiled by J. C. McCabe, Associate Editor

Company	Location	Consulting engineers	First operation, mo. and yr.	Annual delivery requirements, Btu	Normal pressure, psi	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft
600 PSI AND ABOVE													
Dow Chemical Co, Plant "B"	Freeport, Texas	Stone & Webster Engrg Corp	12-51	1250	900	2	450	RS	32.3	22.6	30.0	DB	8.2
			12-52	1250	900	2	450	RS	32.3	.....	30.0	DB	8.2
Dow Chemical Co, Plant "A"	Freeport, Texas	Stone & Webster Engrg Corp	9-52	1250	900	3	450	RS	35.3	22.0	30.5	DB	8.2
Dow Chemical Co	Midland, Mich	Self	3-53	1250	835	2	400	BW	21.0	.....	.....	ST	19.1
Northern Paper Mills	Green Bay, Wis	Sargent & Lundy	.....	1250	950	1	135	RS	11.9	5.9	20.0	.....	.....
Carbide & Carbon Chemicals Co	Texas City, Texas	Ebasco Services, Inc	1-53	1076	850	2	250	RS	21.6	10.0	30.5	DB	.....
Republic Steel Corp	Cleveland, Ohio		.....	1040	850	2	228	BW	28.2	.....	.....	.....	.....
Republic Steel Corp	Youngstown, Ohio		.....	1040	850	2	220	BW	28.2	.....	.....	.....	.....
Columbia Southern Chemical Corp	Corpus Christi, Texas		.....	1000	825	1	300	BW	29.5	.....	.....	.....	.....
Container Corp of America	Fernandina, Fla	J. E. Sirrine Co	1-53	1000	825	1	200	BW	14.1	8.5	31.4	.....	0
Dow Chemical Co	Pittsburg, Calif	C. C. Moore & Co	4-52	1000	950	1	280	BW	54.0	8.5	31.0	DB	0
Kaiser Aluminum & Chemicals Co	Chalmette, La		1952	1000	905	6	225	FW	30.4	8.6	35.0	DB	0
Monsanto Chemical Co	Everett, Mass	Self	10-52	980	825	1	100	RS	11.0	4.5	27.7	DB	.....
Diamond Alkali Co	Deer Park, Texas		.....	975	900	1	100	CE	11.5	5.7	.....	.....	0
Goodyear Tire & Rubber Co	Akron, Ohio	Sargent & Lundy	1-53	975	635	2	220	BW	26.6	16.2	16.7	DB	.....
International Paper Co	Moss Point, Miss		11-51	960	825	2	157	CE	.....	.....	.....	.....	.....
				950	825	2	175	BW	11.1	6.3	.....	.....	.....
Columbia Southern Chemical Corp	New Martinsville, W. Va	Sargent & Lundy	7-52	900	900	1	325	RS	36.4	24.0	17.6	DB	0
Aluminum Ore Co	East St. Louis, Ill		4-51	900	850	1	100	BW	8.8	6.0	21.0	DB	0.7
Youngstown Sheet & Tube Co	Indiana Harbor, Ind		.....	900	760	1	300	BW	31.2	.....	.....	DB	.....
U. S. Steel Corp	South Chicago, Ill		1951	900	900	1	65	.....	.....	.....	.....	.....	.....
U. S. Steel Corp	Morrisville, Pa	Gibbs & Hill, Inc	.....	885	900	1	300	RS	.....	.....	.....	DB	.....
						2	300	RS	.....	.....	.....	DB	.....
Bethlehem Steel Co	Johnstown, Pa		12-51	850	850	.....	.....	.....	.....	.....	.....	.....	.....
North American Rayon Corp	Elizabethton, Tenn	Stone & Webster Engrg Corp	3-52	850	825	2	120	CE	8.2	8.1	20.7	DB	.....
Gulf Oil Corp	Philadelphia, Pa		9-52	725	600	3	300	EC	32.3	14.3	28.2	.....	.....
Hooker Electrochemical Co	Niagara Falls, N. Y.		1-53	725	750	1	265	RS	23.6	13.2	21.9	DB	.....
Monsanto Chemical Co	Texas City, Texas	United Engrs & Constructors	4-52	725	750	4	175	BW	16.5	9.0	30.0	.....	.....
Monsanto Chemical Co	Monsanto, Ill	United Engrs & Constructors	12-52	725	750	1	200	FW	26.1	11.1	26.0	.....	22.9
St. Regis Kraft Corp	Eastport, Fla	Alvin H. Johnson	7-52	725	825	1	134	CE	36.5	12.3	.....	.....	.....
Armour & Co	Chicago, Ill	M. B. Golber	1952	700	750	2	125	CE	17.8	6.6	26.2	.....	0
Hudson Motor Car Co	Detroit, Mich	Roddy-Benjamin Associates	11-52	700	770	3	100	BW	9.0	4.5	30.0	.....	5.2
Kohler Co	Kohler, Wis		11-51	700	750	1	70	Wi	10.8	3.5	28.5	DB	4.0
Monsanto Chemical Co	Nitro, W. Va	Self	12-52	700	750	1	75	EC	11.9	4.3	26.2	.....	1.0
National Container Corp	Tomahawk, Wis	Helmick & Lutz	3-52	700	700	1	67	BW	.....	7.1	.....	.....	.....
Otsego Falls Paper Mills	Otsego, Mich	Cummins & Barnard	2-52	700	750	1	75	Wi	9.0	3.7	.....	.....	7.7
St. Regis Kraft Corp	Eastport, Fla	Alvin H. Johnson	7-52	700	825	1	180	CE	14.4	7.0	.....	.....	0
						1	135	CE	12.9	5.7	.....	.....	0
Texas Co	Lawrenceville, Ill		5-51	700	750	3	300	FW	33.5	16.5	25.0	DB	0
Transcontinental Gas Line	Eunice, La	L. A. Vidrine	6-51	700	600	2	48	BW	4.2	.....	.....	.....	.....
Carbide & Carbon Chemicals Co	Texas City, Texas		1952	675	750	1	155	BW	12.0	5.4	42.0	DB	.....
MacMillan & Bloedel, Ltd	Nanimo, B. C.		5-50	675	Sat.	1	130	CE	20.5	.....	.....	.....	.....
						2	85	CE	11.4	.....	24.7	.....	.....
St. Helens Pulp & Paper Co	St. Helens, Ore		12-52	675	750	1	123	CE	36.7	12.3	.....	ST	7.7
Marathon Paper Mills	Marathon, Ontario	E & B Cowan	2-52	675	715	1	125	CE	15.2	.....	.....	DB	0
Coosa River Newsprint	Childersburg, Ala	J. E. Sirrine Co	1951	650	730	1	93	CE	.....	.....	.....	.....	.....
Ecusta Paper Corp	Pisgah Forest, N. C.	Chas. T. Main, Inc	6-52	650	725	1	115	CE	.....	.....	.....	.....	.....
Fibreboard Products, Inc	East Antioch, Calif	Leland S. Rosenor	1950	650	725	2	160	BW	15.2	.....	28.0	.....	.....
Fraser Paper, Ltd	Madawaska, Me	Stone & Webster Engrg Co	1951	650	750	1	150	CE	12.2	11.4	19.0	.....	.....
International Paper Co	Natchez, Miss		1950	650	715	1	150	BW	13.1	7.8	.....	.....	.....
			1950	650	750	2	112	BW	13.7	14.4	.....	.....	.....
			1950	650	686	1	150	BW	.....	.....	.....	.....	.....
St. Mary's Kraft Corp	St. Mary's, Ga	George F. Hardy & Son	.....	650	750	1	60	BW	7.4	3.4	23.0	.....	.....
						1	100	BW	10.8	5.8	23.0	.....	.....
						1	55	BW	.....	.....	.....	.....	.....
						1	115	CE	.....	.....	.....	.....	.....
Utah Oil Refining Co	Salt Lake City, Utah		1952	650	700	1	65	BW	.....	3.0	27.5	DB	.....
Coosa River Newsprint Co	Childersburg, Ala	J. E. Sirrine Co	1951	625	750	1	67	BW	8.8	.....	.....	.....	.....
Tennessee Eastman Co	Kingsport, Tenn		1951	620	740	3	160	BW	19.0	8.6	23.4	.....	5.5
Canada Packers, Ltd	Toronto, Ont	R. A. Hanright	4-53	610	610	1	100	FW	12.3	.....	.....	.....	7.1
Canadian Celanese Ltd	Drummondville, Ont	Self	10-52	600	725	1	132	FW	13.2	7.5	21.7	DB	.....
Celanese Corp of America	Rock Hill, S. C.		11-52	600	750	2	200	RS	23.9	14.1	18.3	DB	.....
Chesapeake Corp of Va	West Point, Va		1951	600	570	1	90	CE	.....	.....	.....	.....	.....
Columbia Cellulose Ltd	Prince Rupert, B. C.		.....	600	750	2	250	FW[4]	.....	15.2	21.2	.....	.....
Everett Pulp & Paper Co	Everett, Wash	P. R. Sandwell	6-51	600	750	1	80	BW	8.4	.....	.....	DB	.....
Mississippi Corp	Sheldon Springs, Vt.	Pierce Consulting Engrg Co	6-52	600	650	1	60	Wi	7.5	3.0	.....	DB	1.4
National Petro-Chemicals Corp	Tuscola, Ill	J. F. Pritchard & Co	1-53	600	750	3	200	CE	23.7	15.8	16.3	DB	.....
Puget Sound Pulp & Timber Co	Bellingham, Wash		1950	600	Sat.	1	140	BW	13.3	7.0	23.3	.....	0

A – Air cooled
Alm – Aluminum beam
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Bi – Bigelow Co
BI – Black liquor
BM – Bellis and Morcom
Br – Brass
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion-Engineering-Superheater, Inc
CoA – Copper alloy
Cy – Cyclone furnace
D – Deaerator
DB – Dry bottom
DL – DeLaval Steam Turbine Co
Du – Duplex pump
E – Electrostatic
EC – Erie City Iron Works
EJ – Elliott Co
EW – Edge Moor Iron Works, Inc
FB – Foster Wheeler Corp
G – Gas
GE – General Electric Co
H – Hydrogen cooled
HF – Hogged fuel
Hy – Hydraulic coupling
L – Lignite
M – Motor drive
Ma – Magnetic coupling
Me – Mechanical
MI – Murray Iron Works
Mp – Two motors per fan
MT – One motor, one turbine per fan
Mu – Muntz metal
N – Nickel
O – Oil
P – Pulverized-fuel firing
R – Regulator

Institutional Steam Plants, Above 200 Psi

Air-heater surface per boiler, 1000 sq ft	Air-heater type	Dust collectors	F-D FANS: Drive	F-D FANS: Air-flow control	I-D FANS: Drive	I-D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, 1000 Btu per lb	FUEL: Air-heater temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Reduction gear	TURBINES: No. bleed points	Generator cooling	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity laid down units, 1000 lb	Total generator capacity laid down units, 1000 kw
600 PSI AND ABOVE																							
51.9	Ts	...	M		M	D	G, O	G	1.05	...	1M	R	40.0	3600	GE	1.0	1	H	37.5	1	AlBr	3500	225
51.9	Ts	...	M		M	D	G, O	G	1.05	...	2M	R	60.0	3600	WE	1.0	.	H	55.0	1	AlBr		
									1.05	...	3M		90.0	3600	WE	1.0	2	H	37.5	1	AlBr	1350	80
51.5	Tu	...	M		M	D	G, O	G											37.5	1	AlBr	3900	144
134.6	Tu	...	T		S	...	Cy	C	12.9	2200	1M,2T	S,R	30.0	3600	WE	40.0	2	H	...	...	...	...	...
18.2	...	Me	M		M	...	BL	BL			2M,1T	S	2.0	3600	GE	...	...	A	...	...	...	1700	42
38.0	Tu	...	T		S	...	G	G	1.0	...	3T	S	6.3	3600	GE	615	...	...	...	...	...	...	...
104	Ts	...	...		...	...	P,G^2	G^2					...	...	...	...	...	...	...	...	...	...	...
							P,G^2	G^2					...	...	...	...	...	...	...	...	...	...	...
104	Ts	...	...		...	...	G, O	G	1.0	...			20.0	3600	GE	...	...	...	...	...	...	...	...
53.3	Ts	...	...		...	...	O	O	18.3	...	2T	S,R	7.5	3600	WE	0.9	1	A	5.0	2	AlBr	575	17
23.4	Ts	...	M		V	M,T	O,V	O	1.0	...	2T	S,R	...	...	...	...	...	...	...	...	...	370	...
38.6	Ts	...	T		S,V	T	S,O	G, O					10.0[1]	3600	GE	...	...	...	9.3	...	...	1350	200[1]
								G, O	1.0	...	17M,2T	...	20.0	3600	GE	...	...	...	18.6	...	...	305	...
24.5	Re	...	...		...	...	...	...	13.6	2100			...	...	...	...	...	...	...	...	...	500	30
11.9	Tu	Me	MT		S,D	MT	S,D	P, O					...	...	...	...	...	...	...	...	...	1730	67
									1.05	...	1T	S											
18.7	Re	...	M		V	M	V	G	11.0	2000	1M,1T	R	12.5	3600	AC	200	...	A	...	...	...	522	37
49.1	Tu	Me	M		D	M	D	P	3.98	...	2M,1T	S	12.5	3600	GE	75	1	A	...	...	...		
		E	M		D	T	S	BL	1.0	...	1M,2T	S	12.5	3600	GE	1.25	2	A	...	...	...	820	34
...	Tu	...	T		S	...	...	G	11.7	2000			...	...	...	...	...	...	...	...	...	640	18
47.3	Re	Me	M		V	M	V	P	13.5	1900	1M,1T	S,R	7.5	1800	AC	120	...	A	...	...	...	...	...
22.0	Re	Me	M		D	M	D	P					...	...	...	...	...	...	...	...	...	...	...
53.1	Tu	...	...		...	...	...	P,G^2					80.0	3600	...	...	5	...	...	...	...	...	...
			M		S	M	...	P,G^2					30.0	3600	GE	330	...	A	...	...	...	...	...
...	...	...	...		...	...	...	G^2	...	...	3T,2Du	S,R	50.0	3600	AC	1.0	...	A	50.0	...	...	...	...
			M		D	M	D	G^2					20.0	3600	WE	0.75	1	A	15.0	1	Br		
...	...	...	T		S	T	S	G^2					...	...	...	...	...	A	...	...	...	580	23
19.8	Tu	Me	M		D	M	D	P	14.0	2600	1M,2T	R	6.0	3600	WE	275	...	A	...	...	...	1782	80.0
33.4	Tu	...	MT		V	T	V	O,G	1.1	...	4T	S,R	10.0	3600	WE	200	...	A	...	...	...	591	6.0
37.2	Tu	Me	M		V	M	V	P	12.3	2100	1M,1T	R	6.0	3600	...	150	...	A	...	...	...	980	...
24.5	Tu	...	T		S	T	S	G	1.05	...	4T	S	...	...	...	...	...	...	...	...	...	700	...
		Me	T		S	T	S	SS(424)	10.6	1925	1M	R	...	...	...	...	...	...	...	...	...	449	12.0
0.3	...	E	M		D	M	Hy	BL	...	...	...	...	...	...	...	...	...	...	...	...	...	730	...
5.8	Tu	Me	T		S	T	S,D	TG(383)	10.9	2250	2T	S	...	...	...	...	...	...	...	...	...	380	11.5
...	...	Me	T		S	T	S	SS(201)	12.0	2200	1M,2T	S,R	3.5	3600	GE	190	...	A	...	...	...	210	9.0
...	...	Me	T		S	T	S	SS(201)	12.0	2200	2M,1T	S,R	6.0	3600	Wo	1.0	2	A	5.0	2	Ad	210	9.0
...	...	...	M		D	M	D	UF(199)	14.2	2400	2M,1T	S,R	...	...	...	...	...	...	...	...	...	190	...
...	...	...	T		S	T	S	SS(154)	12.2	1975	1T	S	...	...	...	...	2	...	...	...	...	260	5.0
...	...	Me	T		S	M	D	BL	4.4	...	1M,1T	S	5.0	3600	GE	...	2	...	3.0	2	Ad	130	3.5
...	Tu	E	M		D	M	D	BL	...	...	1M,1T	...	3.5	3600	EI	...	2	...	...	...	...	...	...
...	...	Me	Hy		D	M	D	SS(156)	...	...	...	...	...	...	...	...	1	A	9.5	2	CuA	449	12.0
20.0	Tu	...	M		D	M	S,D	O	18.5	...	1M,2T	R	6.0	3600	GE	...	1	A	...	...	...	900	...
12.8	Tu	E	M		D	M	Hy	SS(192)	5.1	...	...	...	6.0	3600	GE	60	1	A	...	...	...	96	2.0
28.0	Re	...	T		S,V	T	S,V	O,G	18.6	...	1M,1T,1Du	R	2.0	5900	DL	2.0	2	A	9.2	2	Ad	1700	42
...	Tu	...	M		D	M	D	G	1.0	...	4M	...	10.0	3600	GE	2.0	1	A	5.8	2	Ad	...	...
...	...	...	T		S,D	T	S,D	G	1.0	...	...	...	...	...	...	...	...	...	...	...	...	300	...
...	Tu	E	M		...	M	Hy	BL	6.5	...	2M,1T	...	...	...	...	...	...	...	...	...	...	...	...
12.9	Tu	...	T		D	T	D	HF,O	18.5	...	1M,1T	...	...	...	...	...	...	...	...	...	...	300	...
...	Tu	E	T		D	T	D	BL	...	...	...	...	...	...	...	...	...	...	...	...	...	515	15.5
15.5	Tu	Me	M		V	Hy	D	SS(208)	3.5	...	...	...	...	...	...	...	...	...	...	...	...	413	16.0
...	...	...	...		...	...	...	BL	...	...	...	...	...	...	...	...	...	A	...	...	...	...	...
...	Tu	Me	T		M	...	...	P	13.5	2300	1M,1T	...	5.0	3600	WE	80.0	...	...	...	...	...	...	...
...	...	...	...		...	...	...	...	...	...	...	...	4.0	3600	GE	150	...	...	...	...	...	...	...
...	...	...	M		V	M	V	O	...	...	1M,2T	...	8.0	3600	GE	1.0	2	...	11.0	...	...	...	...
15.9	Tu	Me	M		D	M	D	P	10.5	1900	1M,2T	R	10.0	3600	WE	...	1	A	6.0	2	Ad	370	20
...	Tu	Me	T		S	T	S	SS(71)	4.9	...	2T	S	...	...	...	...	...	...	...	...	...	415	13.6
...	Tu	E	M		D	T	S	BL	4.6	...	2T	S	6.0	3600	GE	80	1	A	...	...	...	...	...
...	Tu	E	M		D	T	S	G	1.0	...	2M	S	6.0	3600	GE	1.25	2	A	...	...	...	...	...
...	Tu	...	M		D	M	D	...[3]	5.1	...													
...	Tu	...	M		D	M	D	...[3]	5.1	...													
...	Tu	E	M		D	M	Hy	BL	8.0	...	2M,2T	R	3.8	3600	GE	2.0	1	A	3.0	2	AlBr	330	10.1
...	Tu	E	M		D	M	Hy	BL	8.0	...			6.3	3600	GE	2.0	2	A	6.5	2	AlBr		
...	...	...	T		S,D	T	S,D	O,G	1.6	...	3T	S	...	...	...	...	...	...	...	...	...	390	...
8.6	Tu	...	...		...	...	...	HF	13.3	2300			...	...	...	...	...	...	...	...	...	1800	43.5
11.0	Tu	Me	T		S	T	S	SS(370)	10.6	2200	1M,1T	S,R	...	...	...	...	...	...	...	...	...	250	...
4.8	Tu	Me	T		D	T	S	TG(473)	12.0	2350	1M	...	3.5	3600	GE	111	1	A	...	...	...	478	7.5
17.9	Tu	Me	M		D,V	M	D,V	P					6.0	3600	WE	65	2	A	...	...	...	850	27
23.3	Re	E	MT		V	MT	V	P	12.5	2300	1T	R	6.0	3600	WE	1.0	2	A	5.0	2	Ad	...	...
12.7	Tu	...	...		...	...	...	SS(192)	5.5	...			...	...	...	...	...	...	...	...	...	...	...
...	Tu	...	MT		S,D	T	S	SS(540)	...	...	1M,2T	...	7.5	3600	Wo	75	1	...	...	...	...	...	...
													7.5	3600	Wo	1.0	2	...	...	...	...	240	...
5.6	Tu	Me	M		D	M	D	O			1M,1T,10u	...										160	5.0
...	...	Me	M		V	M	Ma	SS(172)	13.4	2100	1M,1T	...	2.5	3600	GE	1.0	1	A	2.8	3	Ad	600	12.0
25.5	Tu	Me	Hy		V	M	D	P	12.0	...	3M,3T	R	6.0	3600	AC	1.25	1	A	6.0	2	Ad	360	...
9.9	Tu	...	T		D	T	D	O	18.4	...	1M,1T	R	...	...	...	...	...	...	...	...	...		

Re – Regenerative
RS – Riley Stoker Corp
S – Speed control
SS – Spreader stoker
ST – Slag tap
T – Turbine drive
To – Torry Steam Turbine Co
TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
Va – Henry Vogt Machine Co
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WH – Waste heat
Wi – Wickes Boiler Co
Wo – Worthington Pump & Machy Corp, Moore Steam Turbine Division
WW – Wood waste
200 – Stoker grate area, sq ft

[1] – Plant to have two 10,000-kw steam turbines, fourteen 20,000-kw turbine-generators for six pot lines. Present two pot lines are served by eighty 1200-kw dc generators, gas-engine driven.
[2] – Blast-furnace gas
[3] – Bark, supplemental oil
[4] – Bark, supplemental gas
[5] – Coke breeze
[6] – Built by Foster Wheeler, Ltd, under Riley Stoker Corp license
[7] – Furfural residue
[8] – Bark and wood refuse

1952 Design Survey: Typical Industrial and

Compiled by J. E. McCabe, Associate Editor

Company	Location	Consulting engineers	First operation, year and mo	Desired steam temperature, °F	Desired steam pressure, psi	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Heating surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat released, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft
Texas Eastman Corp	Longview, Texas		1951	825	750	2	100	BW	—	—	—	—	—
Thilmany Pulp & Paper Co	Kaukauna, Wis	Pfeifer & Shultz	10-51	400	700	—	—	—	—	—	—	—	—
Weyerhaeuser Timber Co	Springfield, Ore	United Engrs & Constructors	8-52	600	675	2	150	CE	—	—	—	—	—
BELOW 400 PSI													
Fibreboard Products, Inc	East Antioch, Calif	Leland S. Rosener	1950	575	700	1	100	BW	—	—	—	—	—
St. Croix Paper Co	Woodland, Me	Sill and Warrington	1951	550	725	1	175	RS	26.8	12.0	20.0	ST	0
Hudson Pulp & Paper Co	Palatka, Fla		10-52	500	725	1	70	BW	—	—	—	—	—
						1	55	BW	—	—	—	—	—
						1	113	BW	—	—	—	—	—
Medford Corp	Medford, Oregon		1951	500	670	1	100	RS	16.0	9.7	18.2	DB	—
Southern Advance Bag	Hodge, La	Self	—	500	750	1	90	BW	—	—	—	—	—
Glidden Co	Chicago, Ill			480	560	1	125	Vo	14.7	7.1	—	—	5.7
Hartford Rayon Corp	Rocky Hill, Conn	J. A. Stevens	3-51	480	600	1	40	CE	5.9	1.8	33.0	DB	—
East Fort Richardson	Anchorage, Alaska	Wyatt & Kipper	12-51	475	750	8	135	EC	12.4	5.8	29.4	DB	3.0
Magnolia Petroleum Co	Beaumont, Texas	Self	6-52	475	675	1	175	RS	12.7	8.2	29.7	—	—
National Plastics Products	Odenton, Md		11-51	475	Sat.	1	45	CE	7.0	—	—	—	—
Nekoosa Edwards Paper Co	Port Edwards, Wis	Chas. T. Main, Inc	10-52	475	700	1	110	CE	11.9	9.0	17.2	—	0
St. Regis Paper Co	Pensacola, Fla		2-52	475	660	1	140	BW	12.2	5.8	32.0	DB	—
Quaker Oats Co	Memphis, Tenn	Stone & Webster Engrg Corp	1953	470	700	1	150	CE	31.2	14.0	—	DB	0
Lee Rubber & Tire Corp	Conshohocken, Pa	F. Leopold		460									
Alaska RR-Chugach Electric Assn, Inc	Anchorage, Alaska	H. W. Beecher	11-52	450	750	3	75	—	—	—	—	—	—
Great Western Sugar Co	Longmont, Colo		10-51	450	570	2	150	EC	18.3	8.3	24.1	—	—
W. C. Hamilton & Sons	Mequon, Pa	H. M. Wilson Co	12-51	450	600	1	50	EM	9.4	4.1	16.0	DB	—
International Paper Co	Bastrop, La		10-49	450	460	2	150	BW	14.4	6.6	—	—	—
Niagara Alkali Co	Niagara Falls, N. Y.		1951	450	460	1	65	BW	6.3	—	—	—	—
Rohm & Haas Co	Houston, Texas		3-52	450		2	40	BW	4.4	1.3	36.1	—	—
Rohm & Haas Co	Bristol, Pa			450	550	3	60	EH	8.7	—	31.4	DB	2.6
St. Joseph Lead Co	Josephtown, Pa		6-52	450	700	1	11	BW	3.9	—	—	—	—
						1	11	BW	3.9	—	—	—	—
St. Regis Paper Co	Pensacola, Fla		2-52	450	660	2	61	BW	6.3	3.7	12.4	ST	1.4
						1	50	BW	8.6	—	24.5	DB	—
Sun Oil Co	Marcus Hook, Pa		6-52	450	Sat.	1	155	BW	13.0	—	—	—	4.0
University of Notre Dame	Notre Dame, Ind	Albert Kahn Associates	10-52	450	750	2	70	UI	8.0	3.5	29.2	—	3.8
Wilputte Coke Oven Div			1952	450	650	3	80	—	—	—	—	—	—
Woodward Iron Co	Birmingham, Ala	Rust Engrg Co		450	600	1	125	EC	22.4	13.6	20.0	DB	—
Cluett, Peabody & Co	Waterford, N. Y.	J. L. Ottenheimer	12-51	425	580	1	60	RS	7.1	3.6	—	DB	0
Dow Chemical Co	Freeport, Texas	Stone & Webster Engrg Corp	10-51	425	750	2	250	RS	19.5	11.0	34.2	DB	—
International Paper Co	Bastrop, La		1951	425	775	1	122	BW	—	—	—	—	—
Olson Rug Co	Chicago, Ill	M. E. Plumer	2-52	425	750	2	30	WB	—	1.5	—	—	—
United Realty Inc	Roxbury, Mass	Pierce Consulting Engrg Co	1-52	425	650	1	25	Wi	2.6	0.6	—	DB	—
Univ. of Oklahoma	Norman, Okla	Condon & Frankfurt		425	725	2	50		10.0	—	—	—	—
American Enka Corp	Lowland, Tenn		6-52	410	725	1	130	BW	11.3	—	—	DB	—
Buffalo, N. Y. Pumping Sta	Buffalo, N. Y.		11-51	400	700	2	60	BW	9.7	3.2	29.4	—	—
Eli Lilly & Co	Lafayette, Ind	H. K. Ferguson Co		400	700	3	65	BW	6.6	6.6	—	DB	—
Hershey Chocolate Corp	Hershey, Pa		1952	400	—	—	—	—	—	—	—	—	—
Lone Star Steel Co	Lone Star, Texas	D. C. Pfeiffer	7-52	400	750	2	150	BW	—	—	—	—	—
Michigan Carton Co	Battle Creek, Mich		5-51	400	—	—	—	—	—	—	—	—	—
National Lead Co	Sayreville, N. J.	United Engrs & Constructors		400	—	—	—	—	—	—	—	—	—
Quaker Oats Co	Memphis, Tenn	Stone & Webster Engrg Corp	6-53	400	700	1	165	CE	21.8	14.0	19.3	—	—
Rath Packing Co	Waterloo, Iowa	Helmick & Lutz	5-52	400	—	—	—	—	—	—	—	—	—
Republic Steel Corp	Cleveland, Ohio			400	715	1	220	BW	28.2	—	—	DB	—
Univ. of North Carolina	Chapel Hill, N. C.			400	750	—	—	—	—	—	—	—	—
Virginia Railway Co	Norcross, Va	Gibbs & Hill, Inc	1949	400	—	1	200	FW	19.1	16.3	15.5	—	—
Douglas & Lomason Co	Detroit, Mich		7-51	375	417	1	6	CE	—	—	—	—	—
Canadian National Rwys	Montreal, Que	G. Harding		350	520	3	90	BW	—	—	—	—	—
J. Greenebaum Tanning Co	Milwaukee, Wis	Gales, Moe, Weiss & Papenthien		350	650	3	45	Wi	7.3	2.5	28.0	DB	—
Kurth Malting Co	Milwaukee, Wis	Gales, Moe, Weiss & Papenthien	6-51	350	650	1	50	MI	4.6	2.5	28.1	DB	5.4
Scott Valve Co	Detroit, Mich		4-51	350	Sat.	1	4.0	Bi	—	—	—	—	—
Gen'l American Tank Storage	Bedford Park, Ill	McGee	6-51	325	430	2	6	CE	—	—	—	—	—
Bethlehem Steel Co	Lackawanna, N. Y.			300	650	1	250	CE	11.7	—	—	—	—
Conners Cooperative Steam	Terminal Island, Calif	M. A. Nishkian	10-51	300	Sat.	4	100	UI	9.0	3.1	40.0	DB	—
Commercial Solvents Corp	Terre Haute, Ind		8-51	300	Sat.	1	30	FW	3.5	1.6	26.0	—	—
Lever Brothers	Los Angeles, Calif	Bechtel Corp		300	406	3	85	BW	34.0	—	—	—	—
Rochester State Hospital	Rochester, Minn	Ellerbee Co	3-51	300	750	2	30	WB	2.6	—	—	—	—
United States Rubber Co	Mishawaka, Ind	Boddy-Benjamin Associates	3-52	300	Sat.	3	125	RS	15.3	8.7	17.4	DB	0
C. K. Williams & Co	East St. Louis, Ill	Rogers-Schmidt	2-52	300	550	1	100	EC	12.1	4.7	26.0	DB	—
Pennsylvania Salt Mfg Co	Portland, Ore		5-51	290	420	1	80	BW	—	—	—	—	—
Canadian International Paper	Gatineau, Que	W. T. Bennett	9-52	275	450	1	200	CE	18.3	20.0	17.4	DB	—
St. Regis Paper Co	Tacoma, Wash		1951	275	500	1	80	BW	9.2	4.6	21.7	—	0
Spruce Falls Power & Paper Co	Kapuskasing, Ont	Kimberly-Clark	8-52	275	560	1	170	CE	16.1	9.3	21.1	DB	—
Byrd & Son, Inc	Shreveport, La	Rust Engrg Co	1951	270	Sat.	1	30	RS	—	—	—	—	—
American Box Board Co	Grandville, Mich		7-51	255	450	2	15	Wi	2.7	1.0	21.5	DB	—
Pennsylvania State College	State College, Pa		—	255	530	1	40	BW	—	—	—	—	—

A – Air cooled
AlBr – Aluminum brass
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Bi – Bigelow Co
BL – Black liquor
BM – Bellis and Morcom
Br – Brass

BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion-Engineering-Superheater, Inc
CuA – Copper alloy
Cy – Cyclone furnace
D – Dumper
DB – Dry bottom

DL – DeLaval Steam Turbine Co
Du – Duplex pump
E – Electrostatic
ECo – Erie City Iron Works
El – Elliott Co
EM – Edge Moor Iron Works, Inc
FW – Foster Wheeler Corp
G – Gas

GE – General Electric Co
H – Hydrogen cooled
HF – Hogged fuel
Hy – Hydraulic coupling
L – Lignite
M – Motor drive
Ma – Magnetic coupling
Me – Mechanical

MI – Murray Iron Works
Mp – Two motors per fan
MT – One motor, one turbine per fan
Mu – Muntz metal
Ni – Nickel
O – Oil
P – Pulverized-fuel firing
R – Regulator

Institutional Steam Plants, Above 200 Psi

Air-heater surface per boiler, 1000 sq ft	Air-heater type	Dust collectors	F–D FANS: Drive	F–D FANS: Air-flow control	I–D FANS: Drive	I–D FANS: Gas-flow control	Firing	FUEL: Type	FUEL: Heating value, Btu per lb	FUEL: Ash-fusion temperature, F	FEED PUMPS: Drive	FEED PUMPS: Flow control	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Steam pressure, psig	TURBINES: No. bleed points	Operation: Welding	CONDENSERS: Surface, 1000 sq ft	CONDENSERS: No. water passes	CONDENSERS: Tube material	Total boiler capacity, hot new units, 1000 lb	Total generator capacity, hot new units, 1000 kw
.....	Tu	...	T	S	T	.....	G, O	G	1.0	.....	3T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	200	.....
.....	Tu	Me	M	D	Mp	D	SS	HF	5.4	.....	1M,1T	.....	6.0 12.5	3600 3600	GE GE	50 0.75	1 2	A A	.....	.. 2	.....	210 700	7.2 25
.....	...	...	T	V	T	V	BL	BL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
38.5	Tu	...	M	D,V	M	D,Hy	P	C	11.6	2000	3M,1T	.....	5.0	3600	GE	.....	2	P	5.5	2	Mo	450	12.0
.....	...	...	.....	.....	.....	.....	O _3	O _3	.....	.....	.....	.....	10.0	3600	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	.....	.....	.....	.....	BL	BL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13.1	Tu	Me	M	D	T	S	WW	WW	4.5	.....	1T	.....	2.5	3600	EI	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	M	V	T	S	_4	_4	.....	.....	2T	S	4.0	3000	GE	2.0	3	A	4.4	2	Ni	500	12.5
.....	...	Mp	MT	V	M	D	SS	C,O	11.6	2200	1M,1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	215	.....
1.7	Tu	Me	M	V	M	D	SS,O	O	.....	.....	3T	S,R	1.0	3600	GE	30.0	..	A	.....	..	.....	120	3.0
7.0	Tu	Me	2M, 1MT	V	2M, 1MT	D	SS(291)	C	10.5	.....	4½,4T	S,R	12.0 6.0	3600 3600	Wo Wo	115	1 1	A A	4.3	2	Ad	1080	18.0
16.2	Re	...	T	S	T	S	G,O	G	1.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2790	32.0
.....	...	...	M	D	M	D	O	O	.....	.....	2 Du	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	75	.....
18.5	Tu	Me	M	V	M	Ma	P	C	10.8	2300	1T	R	6.0	3600	EI	1.0	1	A	4.5	2	Br	340	15.0
14.3	Tu	...	M	D	M	D	G	G	1.0	.....	1M,1T	.....	5.0 5.0	3600 3600	WE WE	50 ..	1 ..	A A	6.0	2	Ad	280	20.0
31.0	Tu	Me	M	D	M	D	_7	_7	7.0	1800	2M	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.0	3600	EI	140	..	A	.....	..	.....	.....	.....
.....	...	...	.....	.....	.....	.....	SS(185)	C	.....	.....	.....	.....	5.0 0.5	3600 3600	Wo WE	0.75 0.75	.. ..	A A	.....	..	.....	225	9.5
10.4	Tu	...	M	V	M	D	SS(285)	L	9.2	2500	1M,1T	S,R	3.5	3600	GE	45	..	A	.....	..	.....	330	3.5
5.4	Tu	...	M	V	T	D	O	O	18.0	.....	2T	S,R	.....	.....	.....	.....	.....	.....	.....	.....	.....	110	.....
.....	...	...	.....	V	MT	D	G	G	1.0	.....	1M,2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	225	0.3
6.6	Re	Me	T	S,D	T	.....	P	C	13.2	2400	1M,2T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	195	.....
.....	...	...	.....	.....	T	D	G	G	1.0	.....	1M,2T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	105	.....
.....	...	Me	M	V	MT,M	D	SS(118)	C	13.5	2250	2M,1Du	.....	2.0	3600	WE	15	1	A	.....	..	.....	270	2.0
.....	...	Me E	T	S	.....	S	WH	.....	.....	.....	.....	.....	2.5	3600	GE	25	1	A	4.3	2	.....	90	3.8
5.0	Tu	E	T	D	M	D	BL	BL	4.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	280	20.0
.....	...	Me	T	D	M	D	_8	_8	4.5	.....	1M,1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	T	S	T	S	O,G	O	20.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1150	.....
.....	...	Me	MT,M	V	MT,M	D	SS(142)	C	11.2	2100	2M,1T	.....	2.0	3600	EI	1.0	1	..	2.3	..	AlBr	180	4.0
.....	...	...	T	V	.....	.....	TG(374)	_5	10.5	.....	2M	S,R	.....	.....	.....	.....	.....	.....	.....	.....	.....	240	.....
.....	...	...	T	D	.....	.....	_2	_2	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	650	9.0
7.0	...	Me	MT	D	MT	D	P	C,O	14.2	2250	1M,1T,1Du	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21.0	Tu	...	M	D	M	D	G,O	G	1.0	.....	1M	R	30.0	3600	GE	1.0	1	H	32.5	1	AlBr	2500	117.5
.....	Tu	...	M	D	T	S	BL	BL	4.0	.....	1M,2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	598	11.2
.....	...	Me	Mp	S,D	Mp	.....	SS	C,G	.....	2300	20U	R	3.5	3600	.....	10	..	A	.....	..	.....	130	3.5
.....	...	...	M	V	.....	.....	O	O	18.3	.....	1M,1T	.....	0.7	3600	GE	1.0	..	A	0.8	2	Ad	40	1.0
5.7	Tu	...	T	S,V	T	S,D	O,G	O,G	.....	.....	1M,2T	.....	5.0	3600	WE	1.0	1	..	.....	..	.....	.....	.....
21.7	Tu	Me	T	S	T	S	P	C	13.8	2600	.....	.....	5.0	3600	EI	18.0	1	A	5.8	2	Ad	520	29.7
.....	...	...	M	D	.....	D	SS(121)	C	13.5	2400	1M,1T	R	0.6	3600	Wo	1.0	0	A	.....	..	.....	280	0.6
.....	...	Me	M	D	MT	D	SS(152)	C	11.5	2100	1M,2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	200	.....
.....	...	...	.....	.....	.....	.....	O,G[2]	O,G[2]	.....	.....	.....	.....	7.5	3600	WE	.....	1	A	9.5	2	.....	700	28.5
.....	...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.0	3600	GE	1.5	2	..	.....	..	.....	750	25.0
.....	...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.0	3600	EI	35	1	A	.....	..	.....	120	2.0
.....	...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	3600	GE	45	1	A	.....	..	.....	500	16
31.0	Tu	Me	M	V	M	V	G[2]	G[2]	8.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	300	.....
.....	...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.0	3600	EI	60	1	A	.....	..	.....	310	5.0
52.0	Tu	...	.....	.....	.....	.....	G[2]	G[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
27.1	Re	Me	.....	.....	.....	.....	P	C	14.2	.....	2M,1T	.....	10.0 10.0	3600 1500	Wo GE	1.25 0.5	1 ..	A ..	.....	..	.....	.....	.....
.....	...	...	M	D	M	D	G	G	1.0	.....	1Du	S,R	.....	.....	.....	.....	.....	.....	.....	.....	.....	22	.....
3.9	Tu	...	MT	V	M	Hy	P SS(161)	C C	11.3	2100	1M,2T	S,R	1.0 0.8	4500 4500	BM Te	1.0 20	1 1	A A	.....	..	.....	270 135	1.0 1.6
.....	...	Me	M	V	M	D	SS(126)	C,O,G	10.8	2100	1M,1T	.....	1.5	3600	Mi	30	..	A	.....	..	.....	76	1.5
.....	...	...	.....	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	M	D	.....	D	O _3	O _3	18.0 0.1	.....	1 Du	S,R	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	.....
29.6	Tu	...	.....	.....	.....	.....	.....	.....	18.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7.1	Tu	...	3T,MT	V	3T,MT	D	O,G	O	18.0	.....	1M,2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	400	.....
.....	...	...	M	D	M	D	SS(74)	C	11.0	2000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15.1	Tu	...	M	D	M	V	O,G	G	1.05	.....	3M	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	255	.....
3.5	Tu	...	M	V, Hy	T	S	O,G	O	18.0	.....	1M,2T	S	0.5	5200	Wo	.....	..	A	0.8	2	Br	60	1.5
21.5	Tu	Me	T	S	T	S	P	C	10.5	2050	1M,2T	S,R	1.0	5200	Wo	50	..	A	.....	..	.....	375	.....
6.8	Tu	Me	M	D	MT	D	TG(184)	C	10.0	.....	2T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	150	.....
.....	...	...	.....	.....	.....	.....	O	O	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	170	.....
23.4	Tu	Me	M	D	M	D	P	C	13.5	2500	2M,1T	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	900	.....
4.2	Tu	...	M	D	M	D	O	O	18.0	.....	4T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	130	.....
17.7	Tu	Me	M	V	T	S	P	C,WW	12.5	2600	1M,1T	R	.....	.....	.....	.....	.....	.....	.....	.....	.....	640	18.0
.....	...	...	.....	.....	.....	.....	G	G	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	M,T	D	M,T	D	UF	C	12.0	.....	1M,1T	S,R	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	...	...	.....	.....	.....	.....	UF	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Re – Regenerative
RS – Riley Stoker Corp
S – Spool control
SS – Spreader stoker
ST – Sling tap
T – Turbine drive
Tu – Terry Steam Turbine Co

TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
Va – Henry Vogt Machine Co
WB – Wm Cros Boiler & Mfg Co

WE – Westinghouse Electric Corp
Wst – Waste heat
Wi – Wickes Boiler Co
Wo – Worthington Pump & Machy Corp, Moore Steam Turbine Division
WW – Wood waste
285 – Stoker grate area, sq ft

[1] – Plant to have two 10,000-kw impulse turbines, fourteen 20,000-kw turbine-generators for six pot lines. Present two pot lines are served by eighty 1200-kw dc generators, gas-engine driven.
[2] – Blast-furnace gas

[3] – Bark, supplemental oil
[4] – Bark, supplemental gas
[5] – Coke breeze
[6] – Built by Foster Wheeler, Ltd, under Riley Stoker Corp license
[7] – Furfural residue
[8] – Bark and wood refuse

1952 Design Survey: Typical Industrial,

Compiled by J. C. McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation date units	Steam pressure, psi	Rated steam temperature, F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	Firing	TURBINES: Capacity, kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Designation, para	TURBINES: No. of bleed points	Total boiler capacity (not new units), 1000 lb	Total generator capacity (all new units), 1000 kw
201 TO 250 PSI																
Air Engrg Development Center	Tullahoma, Tenn	Robert & Co	3-52	250	387	1	20	EM	SS (75)						200	
						3	60	EM	P							
Armour & Co	Alliance, Ohio	M. B. Golber	1950	250	388	2	20[1]	BW	O						120	
Armour & Co	Bradley, Ill	Hellabrd, Root & Burgee	12-52	250	Sat.	3	40	BW	TG (132)							
Atlantic Refining Co	Philadelphia, Pa		1952	250	Sat.	1	30	Bi	WH							
Aurora Gasoline	Detroit, Mich		7-51	250	Sat.	1	35	Bi	O							
Bear Creek Vineyard	Lodi, Calif	G. E. Rahm	9-51	250	Sat.	1	20	Bi	O,G							
Belchertown State School	Belchertown, Mass	McClintock & Craig, Inc	10-51	250	Sat.	1	20	Bi	O						100	
Calloway Mills Co	Lagrange, Ga			250	Sat.	1	60	CE	G,O						200	
Canadian Oil Refineries, Ltd	Fraserfield, Ont	Stone & Webster	4-52	250	475	2	100	BWG	G,O							
Clinton Foods, Inc	Auburndale, Fla	B. C. Skinner	11-51	250	404	1	65	UI	O	1.3	.....	GE	5.0	2		
Deep Freeze Div. Motor Products Corp	Lake Bluff, Ill	Austin Co	2-51	250	355	2	18	BW	G,[2]O						40	
Dixie Pine Products Co	Hattiesburg, Miss			250	388	1	30	RS	SS (98)						120	
Ethyl Corp	Pasadena, Texas		4-51	250	398	3	85	BW	G						85	
Fieldcrest Mills	Spray, N. C.	Robert & Co	11-51	250	358	1	77	BW	SS (186)						95	
Fort Wayne Corrugated Paper	Rochester, N. Y.	Austin Engr	12-51	250	Sat.	2	35	BW	O						30	
Fosgate Citrus Concentrate Coop	Forest City, Fla	A. P. Michael & Son	1952	250	Sat.	2	27	EC	O							
General Motors Corp, Delco Div	Rochester, N. Y.		11-51	250	Sat.	1	20	CE	SS (61)							
Gulf Oil Corp	Euless, N. M.			250	600	2	60	Wi	G[3]							
Howard University	Washington, D. C.		1-52	250		1	50	EC	UF (140)	1.0	3600	GE	14.7	0	140	2.1
Inland Container Corp	Indianapolis, Ind	W. I. Barrows	12-51	250	Sat.	1	30	Vo	TG (116)						50	
Kansas State Teachers College	Pittsburg, Kan		12-51	250	Sat.	1	20	WB	SS						70	
Kirsch Co	Sturgis, Mich	W. Hawley	12-51	250	Sat.	1	55	UI	O						110	0.6
Libbey-Owens-Ford Glass	Ottawa, Ill		11-51	250	550	1	150	BW	SS (347)						690	15.5
Lowe Paper Co	Ridgefield, N. J.	F. L. Smith	2-52	250	Sat.	1	25	FW	0						85	
National Container Corp	Ontonagon, Mich	Helmick & Lutz	6-51	250	475	1	50	CE	SS (150)						160	3.5
N. Y. Butchers Dressed Meat	New York, N. Y.	M. B. Golber	8-50	250	Sat.	2	50	CE	O						100	
Publishers Paper Co	Oregon City, Ore	H. W. Beecher		250	500	1	80		UF							
Red Star Yeast & Products Co	Belle Chasse, La	E. A. Rose	4-52	250	500	1	25.5	BW	G						25.5	
State Prison, So. Mich	Jackson, Mich	Fargo Engrg	2-52	250	500					1.5	3600	WE	1.0	1	200	3.0
Visking Corp	Terre Haute, Ind	J. Blankenship	9-51	250	806	1	11	BW	O,G						18.4	
Best Foods, Inc	Chicago, Ill		6-52	230	Sat.	1	40	EC	O						62	
Aetna Oil Co	Louisville, Ky		12-51	225	353	1	36	Vo	O,G						1380	5.4
Buick Motor Co	Flint, Mich		10-52	225	430	1	225	CE	P							
Ford Motor Co	Kansas City, Mo	Giffels & Vallet	9-52	225	Sat.	2	100	Wi	O,G						270	
						1	70	Wi	O,G							
Ford Motor Co	Wayne, Mich	Giffels & Vallet	5-52	225	Sat.	2	70	Wi	TG						185	
						1	45	Wi	TG						45	
Liquid Carbonic Corp	Seattle, Wash			225	475	1	14	BW	O							
Norfolk & Western Ryy	Roanoke, Va			225	475	3	70	BW	SS (125)							
251 PSI																
American Zinc Co	East St. Louis, Ill	Lockwood Greene Engrs	5-51	200	Sat.	1	30	EC	G						75	
Baldwin Co	Cincinnati, Ohio		1952	200	Sat.	2	12.5	BW	SS (42)						25	
Briggs Mfg Co	Detroit, Mich		4-52	200	Sat.	1	75	Wi	O,G						111	
Bristol Co	Waterbury, Conn		10-51	200	Sat.	2	10	Bi	O							
Buick Motor Co	Willow Springs, Ill		9-52	200	Sat.	3	66	BW	SS (98)						198	
Buick Motor Co	North Flint, Mich	Albert Kahn Assoc	9-52	200	Sat.	3	150	BW	SS (274)						450	
Bureau of Standards	Washington, D. C.		1952	200	Sat.	1	30	Bi	O							
Coldwater State Home	Coldwater, Mich	Cummins & Barnard, Inc		200	450	1	40	Wi	SS (110)						100	
Connecticut Reformatory	Cheshire, Conn	Hubbard, Lawless & Blakely	1952	200	Sat.	1	12	Bi	O							
Crowe-Hinds Co	Syracuse, N. Y.	C. R. Acherson	1952	200	Sat.	1	60	BW	P						150	
Eielson A. F. Base	Fairbanks, Alaska	Lincoln Bouillon & Assoc	1951	200	Sat.	4	10	BW	O						40	
Fairbanks, Morse & Co	Beloit, Wis	Stone & Webster	3-51	200	465	3	80	CE	SS (150)						200	
Falstaff Brewing Corp	New Orleans, La	Peter Cheporis	1951	200	358	2	50	BW	G						100	
Federal Wire & Cable Co., Ltd	Guelph, Ont		6-52	200	336	1	20	FW	SS (68)						30	
Fort Richardson, U. S. Army	Anchorage, Alaska	Lincoln Bouillon & Assoc	1951	200	Sat.	2	15	BW	O						30	
General Motors Corp, Frigidaire Div	Dayton, Ohio		{(2) 51 (2) 52}	200	Sat.	4	90	BW	P						740	
Grace New Haven Hospital	New Haven, Conn		1952	200	Sat.	1	33	Bi	O						69.5	
Harris-Seybold Co	Cleveland, Ohio			200	Sat.	1	16.5	EC	P							
Hudson Pulp & Paper Corp	Augusta, Me		2-52	200	490	1	70	Wi	O							
Inrotech, Inc	Stamford, Conn		11-51	200	Sat.	2	20	EC	C,W[4]						40	
Kelsey Wheel Co., Ltd	Windsor, Ont		10-51	200	375	1	28	FW	SS (91)						43	
Keyes Fibre Co	Waterville, Me		1952	200	352	3	26	BW	O						78	
L. I. Agricultural & Technical Inst	Farmingdale, N.Y.		1952	200	Sat.	4	27	Bi	O							
Lubrizol Corp	Wickliffe, Ohio		1952	200	Sat.	1	25	EC	O						60	
Marathon Corp	Ashland, Wis			200	Sat.	2	18	EC	SS (140)						45	
Monsanto Chemical Co	Carondelet, Mo		9-52	200	Sat.	1	40	Vo	TG (130)						70	
Nash Kelvinator Corp	New York & Penna Co		2-52	200	410	1	90	BW	SS (200)						390	
			11-51	200	388	1	50	EC	TG (190)						62	0.42
Norfolk State Hospital	Norfolk, Mass		5-52	200	Sat.	2	{34 29}	MI	O	0.5	3600	MI	3	0	63	0.5
Paton Mfg Co., Ltd	Sherbrooke, Que	E. B. Jubien	7-52	200	353	2	20	FW	O						60	
Personal Products Co	Milltown, N. J.		9-51	200	Sat.	1	43.5	EC	O						130.5	
Reformatory for Women	Framingham, Mass	John A. Steven	12-51	200	Sat.	3	10	Bi	O							
Schering Corp	Union, N. J.		1-52	200		1	30	BW	O, G						55	
State Teachers College	Slippery Rock, Pa	Rust Engrg.Co	1952	200	Sat.	2	20	BW	UF (72)						48	
Spencer Kellogg & Sons Co	Bellevue, Ohio		11-52	200	Sat.	1	40	EC	SS (132)						90	
University of Idaho	Moscow, Idaho			200	Sat.	1	40	CE	SS (112)							

AC – Allis-Chalmers Mfg Co
An – Anthracite
Bi – Bigelow Co
BW – Babcock & Wilcox Co

BWG – Babcock & Wilcox, Goldie McCulloch
C – Coal, bituminous
CE – Combustion Engineering-Superheater Inc

CV – Canadian Vickers Ltd
EC – Erie City Iron Works
El – Elliott Co
EM – Edge Moor Iron Works Inc

FW – Foster Wheeler Corp
G – Gas
GE – General Electric Co
IB – International Boiler Works

MI – Murray Iron Works Co
O – Oil
P – Pulverized-fuel firing
RS – Riley Stoker Corp

Institutional Plants, 250 Psi and Below

Compiled by J. C. McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation new units	Reheat provision, yes	Reheat steam temperature, °F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Firing	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Bleedpressure, psia	No. of bleed points	Total boiler capacity, last new units, 1000 lb per hr	Total generator capacity, last new units, 1000 kw
U. S. Capitol Power Plant	Washington, D. C.	Guy B. Panero	1952	200	Sat.	3	120	Wi	SS	----	----	----	----	--	----	----
Victor Chemical Works	Silver Bow, Mont		9-51	200	Sat.	2	16	UI	G	----	----	----	----	--	32	----
Vickery Mills, Ltd	Toronto, Ont		12-51	200	477	1	50	FW	SS (143)	----	----	----	----	--	117	----
Westinghouse Friendship Plant	Hetuchen, N. J.	Whitman, Requardt & Assoc	1952	200	----	2	30	BW	O, G	----	----	----	----	--	60	----
Weston Paper & Mfg Co	Terre Haute, Ind	Rust Engrg Co	10-51	200	388	1	22	UI	UF (63)	----	----	----	----	--	66	----
West Virginia University	Morgantown, W. Va		11-50	200	440	3	50	BW	TG (160)	----	----	----	----	--	150	----
Wilco Chemical Co	Chicago, Ill		----	200	350	2	20 35	BW	O, G	----	----	----	----	--	55	----
151-199 PSI																
Eli Lilly Co	Indianapolis, Ind		7-51	190	Sat.	1	75	BW	SS (122)	----	----	----	----	--	240	----
Chrysler Corp	Warren, Mich	Albert Kahn Assoc	1952	185	Sat.	3	100	Wi	SS	----	----	----	----	--	----	----
Fibreboard Products Inc	Sumner, Wash		1951	185	Sat.	1	18.4	BW	O	----	----	----	----	--	60	----
True Temper Corp	Geneva, Ohio		----	180	----	2	19	BW	SS (C,G,W)	----	----	----	----	--	38	----
Union Oil Co	Edwards, Wash	Bechtel Corp	1951	180	Sat.	1	20	BW	O	----	----	----	----	--	20	----
Chrysler Corp	Newark, Del	Albert Kahn Assoc	6-52	175	Sat.	3	70	Wi	O	----	----	----	----	--	----	----
Skelly Oil Co	El Dorado, Kan		4-51	175	500	1	120	Wi	O,G	----	----	----	----	--	378	----
Syracuse University	Syracuse, N. Y.	Robsun & Woese	10-52	175	550	2	150	RS	P	1.0	----	----	5	--	300	1.0
Upjohn Co	Kalamazoo, Mich	Austin Co	----	175	----	4	60	UI	----	----	----	----	----	--	----	----
Western Electric Co	Indianapolis, Ind		1951	170	Sat.	3	60	UI	SS	----	----	----	----	--	180	----
Worcester Pressed Steel Co	Worcester, Mass		8-51	167	240	1	12	RS	O, G	----	----	----	----	--	20	----
Ensign Bickford	Simsbury, Conn		9-51	165	Sat.	2	7.3	Bi	O	----	----	----	----	--	----	----
Lewis Jones Inc	Philadelphia, Pa		2-51	165	345	1	80	Ed	O	----	----	----	----	--	280	----
Overbrook Steam Heat Co	Philadelphia, Pa		1-51	165	750	1	35	CM	O	----	----	----	----	--	300	----
University of Detroit	Detroit, Mich	Harley, Ellington & Day	9-52	165	Sat.	1	35	Vo	TG (90)	----	----	----	----	--	83	----
American Cyanimid Co	Stamford, Conn		9-51	160	Sat.	1	21	BL	O	----	----	----	----	--	----	----
American Cyanimid Co	Woodbridge, N. J.		10-51	160	Sat.	1	22	EC	O	----	----	----	----	--	28	----
Army Medical Center	Washington, D. C.	Corps of Engrs	1952	160	Sat.	2	75	Bi	O	----	----	----	----	--	----	----
Baltimore Veterans Hospital	Baltimore, Md	Whitman, Requardt & Assoc	7-52	160	----	3	----	CE	O	----	----	----	----	--	----	----
Brown & Williamson Tobacco Corp	Petersburg, Va		1951	160	Sat.	1 2	20 20	RS RS	O UF (67)	----	----	----	----	--	72	----
Buffalo Forge Co	Buffalo, N. Y.		12-51	160	345	1	30	BW	UF (86)	----	----	----	----	--	50	----
Bullard Havens Technical School	Bridgeport, Conn	Hurley-Capocefalo Assoc	12-51	160	Sat.	1	10.5	Bi	O	----	----	----	----	--	----	----
Congoleum Canada Ltd	Montreal, Que		4-52	160	----	1	26	----	TG[3] (89)	----	----	----	----	--	35	----
Drycor Felt Co	Staffordville, Conn	Pierce Engrg Co	11-51	160	240	1	9	EC	O	----	----	----	----	--	12.1	----
Eastern N. C. Sanatorium	Wilson, N. C.	Wiley & Wilson	4-52	160	327	1	17	RS	UF (53)	----	----	----	----	--	51	----
Euclid Rd. Machinery Co	Euclid, Ohio	Mayer & Valentine	5-51	160	----	3	20	EC	C	----	----	----	----	--	60	----
Feather River Pine Mills Inc	Feather River, Calif	G. E. Rahm	11-51	160	Sat.	1	14	Bi	O, G	----	----	----	----	--	----	----
Felisce & Perrelli	Merced, Calif	G. E. Rahm	2-52	160	Sat.	1	40	Bi	O	----	----	----	----	--	----	----
Fruehauf Trailer	Fort Wayne, Ind	Hickey Shaw & Winkler	1-52	160	Sat.	2	33	Bi	C	----	----	----	----	--	----	----
General Installation Co	Jefferson Barracks, Mo	J. Falvey	----	160	----	3	37	Mi	SS (120)	----	----	----	----	--	111	----
Georgia Marble Co	Tate, Ga		2-52	160	----	1	18	CE	UF (60)	----	----	----	----	--	30	----
Grand Army Home for Veterans	King, Wis	Bathy & Childs	11-51	160	352	3	16.5	UI	UF (66)	0.025	1800	EI	2	2	49.5	----
H. J. Heinz Co	Holland, Mich	Peter Loftus	2-52	160	----	3	25	CE	TG (90)	----	----	----	----	--	75	----
Heyden Chemical Co	Garfield, N. J.	H. Schenek	12-51	160	Sat.	1	60	EC	O	----	----	----	----	--	175	----
Holston Valley Community Hospital	Kingsport, Tenn	J. Carver	2-52	160	550	4	9	BW	UF	----	----	----	----	--	10	----
Hooker Electrochemical Co	Tacoma, Wash		1950	160	Sat.	1	67.5	BW	O	----	----	----	----	--	160	----
J. D. Jewell Co	Gainesville, Ga		12-51	160	Sat.	1	14	Bi	O	----	----	----	----	--	----	----
J. J. Joubert Ltd	Nicolet, Que	R. R. Brooks	10-51	160	----	1	16	FW	An	----	----	----	----	--	----	----
TAO Jones & Co	New Haven, Conn		5-52	160	Sat.	1	27	Bi	O	----	----	----	----	--	----	----
Kraft Foods, Inc	South Edmeston, N. Y.		----	160	Sat.	1	20	EC	SS (56)	----	----	----	----	--	30	----
Libby, McNeil & Libby	Chatham, Ont		3-52	160	----	1	45	FW	SS (133)	----	----	----	----	--	115	----
Link Belt Co	Philadelphia, Pa		12-50	160	Sat.	2	7	EM	O	----	----	----	----	--	33	----
The Loomis Institute	Windsor, Conn		5-52	160	Sat.	1	10	Bi	O	----	----	----	----	--	----	----
Masonic Home	St. Louis, Mo	Fred Hume	7-52	160	Sat.	1	12.5	EC	O	----	----	----	----	--	25	----
Middlebury College	Middlebury, Vt		12-51	160	Sat.	1	22	CE	C	----	----	----	----	--	60	----
Water Department	Norfolk, Va	Whitman, Requardt & Assoc	1952	160	----	2	5.6	EC	O	----	----	----	----	--	11.2	----
National Biscuit Co	Chicago, Ill		12-51	160	340	3	25	BW	O, G	----	----	----	----	--	75	----
Newman Cotton Mills	Newman, Ga		----	160	Sat.	2	10	Bi	G	----	----	----	----	--	----	----
Peninsular Paper Co	Ypsilanti, Mich	Commins & Barnard, Inc	11-51	160	Sat.	1	40	EC	SS (81)	----	----	----	----	--	60	----
Pioneer Soap Co	San Francisco, Calif	G. E. Rahm	2-52	160	Sat.	1	14.6	Bi	O, G	----	----	----	----	--	----	----
G. D. Roper Corp	Rockford, Ill	A. C. King	1-52	160	----	1	31	EC	SS (101)	----	----	----	----	--	71	----
St. Mary's Hospital	Cairo, Ill	Long & Underwood	12-51	160	365	2	16.5	EC	O	----	----	----	----	--	----	0.2
St. Joseph Hospital	Burbank, Calif	Lincoln-Bouillon & Assoc	11-51	160	Sat.	2	18	BW	O, G	----	----	----	----	--	36	----
Savard Park Hospital	Quebec, P. Q.		11-51	160	----	2	10	CV	O	----	----	----	----	--	20	----
Jos. Schlitz Brewing Co	Brooklyn, N. Y.	Wm. F. Schier	12-51	160	370	2 1	30 15	EC	O	----	----	----	----	--	75	----
Scovill Mfg. Co	Oakville, Conn		----	160	500	4	20	BW	TG (90)	1.5	3600	----	1	--	80	1.5
State Board of Education	Towson, Md	Whitman, Requardt & Assoc	1-52	160	----	1	30	BW	SS	----	----	----	----	--	50	----
The Torrington Co	Torrington, Conn		11-51	160	Sat.	2	7	Bi	O	----	----	----	----	--	----	----
U. S. Naval Air Facility	Adak, Alaska	H. W. Beecher	1950	160	Sat.	4	20	BW	O	----	----	----	----	--	80	----
Veterans Hospital	Castle Point, N. Y.		11-51	160	Sat.	2	26	Bi	C	----	----	----	----	--	----	----
						1	13.6	Bi	O	----	----	----	----	--	----	----
Valdese Mfg Co	Valdese, N. C.		9-51	160	----	1	24	BW	SS	----	----	----	----	--	----	----
Wamsutta Mills	New Bedford, Mass		----	160	353	2	14	BW	----	----	----	----	----	--	46	----
Watervliet Arsenal, U. S. Army	Watervliet, N. Y.	R. L. Stroani	1-52	160	Sat.	2	50	EC	SS (108)	----	----	----	----	--	215	----
Northern Colony Training School	Chippewa Falls, Wis	Gates, Moe, Weiss & Papenthien	9-51	160	345	3	20	UI	UF	----	----	----	----	--	60	----
U. S. Naval Ammunition Depot	Camden, Ark	Graham, Anderson, Probst & White	1-52	160	337	4	10	BW	G	----	----	----	----	--	160	----
Winnebago State Hospital	Winnebago, Wis	Gates, Moe, Weiss & Papenthien	9-51	160	345	3	20	UI	UF	----	----	----	----	--	60	----
State University of Iowa	Iowa City, Iowa		3-52	155	500	1	75	Wi	SS (172)	----	----	----	----	--	----	----

SS – Spreader stoker
TG – Traveling-grate stoker
UF – Underfeed stoker
UI – Union Iron Works

Vo – Henry Vogt Machine Co
W – Wood
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp

WH – Waste heat
WI – Wickes Boiler Co
(42) – Stoker grate area, sq ft

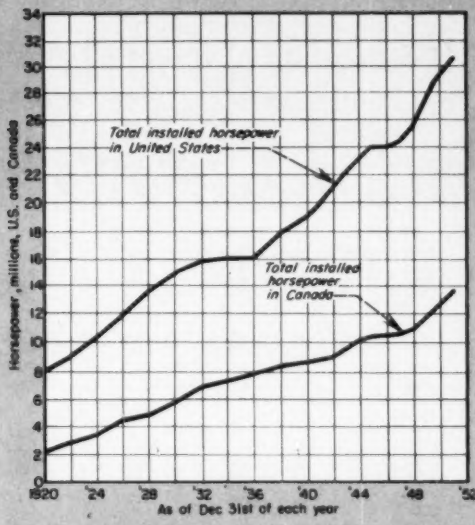
1 – No steam generated; condenses water at 100 F
2 – Propane

3 – Waste exhaust
4 – Hand-fired, coal and wood
5 – Cuba bronze

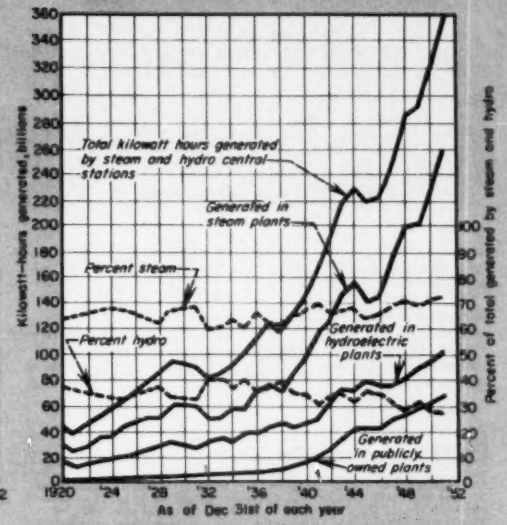
Industrials, Institutionals: Below 200 Psi

Compiled by J. C. McCabe, Associate Editor

Company	Location	Consulting Engineers	First operation (mo-yr)	Nominal pressure, psi	Nominal steam temperature, °F	BOILERS: Number	BOILERS: Capacity, each, 1000 lb per hr	BOILERS: Manufacturer	BOILERS: Firing	TURBINES: Capacity, 1000 kw	TURBINES: Speed, rpm	TURBINES: Manufacturer	TURBINES: Reduction gears, yes/no	No. of bleed points	Total boiler capacity, last new units, 1000 lb	Total generator capacity, last new units, 1000 kw
150 PSI																
American Hardware Corp	New Britain, Conn	Westcott & Mapes	12-51	150	Sat.	6	9	Bi	O							
American Thermos Bottle Co	Norwich, Conn		9-50	150	Sat.	1	10	Bi	O							
Atlantic Tallo Co	Atlanta, Ga		11-50	150	Sat.	1	4	Bi	O							
Henry Bower Chemical	Philadelphia, Pa	J. F. Wolff	11-51	150	Sat.	1	10	Bi	O							
Canadian Acme Screw & Gear Co	Toronto, Ont	H. H. Angus	11-51	150	Sat.	2	15	FW	O						15	
California Wire Cloth Co	Oakland, Calif	G. E. Rahn	8-51	150	Sat.	1	4	Bi	O, G							
Chrysler Corp	Detroit, Mich	Albert Kahn Assoc	1952	150	Sat.	1	150	Wi	UF							
Chrysler Corp	Indianapolis, Ind	Albert Kahn Assoc	11-51	150	Sat.	3	30	Wi	SS							
Cincinnati Milling Machinery Co	Wilmington, Ohio	Austin Co	9-51	150		2	8.75	EC	O, G						17.5	
Cummins Engine Co., Inc	Columbus, Ind	Austin Co	10-51	150	366	1	25	BW	O						48	
Dewey & Almy Chemical Co	West Concord, Mass		6-51	150	Sat.	1	12	Bi	O							
Essex Co	Bridgeport, Conn	Westcott & Mapes	6-51	150	Sat.	1	4	Bi	O							
Edgewater Steel Co	Oakmont, Pa		5-51	150	375	1	30	BW	UF						90	
El Paso Natural Gas	Odessa, Texas		1951	150	Sat.	1	4	Bi	O, G							
Evenson Estate	Boston, Mass		12-51	150	Sat.	1	14.5	Bi	O							
Filtrol Corp	Salt Lake City, Utah		1-51	150	375	3	11	BW	O						33	
Ford Motor Company	Livonia, Mich	Albert Kahn Assoc	9-52	150	Sat.	1 2	40 80	Wi	TG[3]							
General Motors Corp	Pontiac, Mich		1952	150	Sat.	1	100	Wi	SS							
General Motors Corp	Flint, Mich		9-52	150	Sat.	2	80	Wi	SS							
Glenwood Ave & Berk St School	Philadelphia, Pa		12-51	150	Sat.	2	4	Bi	O							
Grand Trunk Western R. R. Co	Detroit, Mich		1950	150	Sat.	6	4.9	Bi	O							
Hartford Empire	Stonington, Conn		11-50	150	Sat.	1	10	Bi	O							
Hughesville Hardwood Corp	Hughesville, Md		7-51	150	Sat.	1	6.5	Bi	W							
Lacey Brewing Co	Cleveland, Ohio	R. H. Hadlow	6-52	150	358	1	32		SS (90)						55	
Langhorne & Sunnyside School	Philadelphia, Pa		11-51	150	Sat.	2	4	Bi	O							
Maclin Zimmer & McGill	Petersburg, Va		7-51	150	Sat.	1	8.1	Bi	O							
Malleable Iron Fittings	Branford, Conn		11-51	150	Sat.	2	14.5	Bi	O							
Martin Rockwell	Plainville, Conn		6-51	150	Sat.	1	16	Bi	O							
Massey-Harris Co	Racine, Wisc	Utility Survey Corp	1-52	150		2	50		SS (150)						120	
Misericordia Hospital	Milwaukee, Wis		10-50	150	Sat.	1	6.4	Bi	O							
Murray State College	Murray, Ky			150	334	2	34	BW	SS (197)						76.5	
National Tube Co	Morrisville, Pa	H. K. Ferguson Co	6-52	150	366	2	85	CE	TG (315)						170	
North American Cement Co	Alsen, N. Y.		1-51	150	Sat.	1	10	Bi	O							
Northwestern Steel & Wire	Sterling, Ill		5-51	150	Sat.	1	9.5	Bi	WH							
Packard Motor Car Co	Utica, Mich	Albert Kahn Assoc	5-52	150	Sat.	3	25	Wi	UF							
Reynolds Metals Co	San Patricio County, Tex	Gordon Turnbull	3-52	150	365	2	6.5	EC	O						13	
J. Rossie Velvet Co	Mystic, Conn		3-51	150	Sat.	1	14.5	Bi	O							
St. Francis Hospital	Hartford, Conn	Wm. J. Carson	10-50	150	Sat.	2	14.5	Bi	O							
Salem High School	Salem, Mass	R. D. Kimball	12-51	150	Sat.	2	7	Bi	O							
Selffocking Corlow	Palmer, Mass		1-52	150	Sat.	1	4.9	Bi	O							
Springfield Municipal Hospital	Springfield, Mass	R. D. Kimball	1952	150	Sat.	4	9	Bi	O							
Stevens Paper Mills, Inc	Windsor, Conn		3-51	150	Sat.	1	7.3	Bi	O							
Swift Mfg Co	Columbus, Ga		1951	150		2	60	BW	P, O						100	
Targett Laundry	Danbury, Conn		7-51	150	Sat.	1	4.9	Bi	O							
Tennessee Prod & Chem Corp	Roc Wood, Tenn		1-52	150	Sat.	2	30	CE	G	50.0	4700	AC	1.5		150	
Textron, Inc	Suncook, N. H.	J. C. Bogue	8-51	150	Sat.	1 1 1	4.9 7.3 15	Bi	O							
Textron, Inc	Manchester, N. H.	J. C. Bogue	9-51	150	Sat.	2 1	15 31	BW	O						61	
Union Tank Car Co	Whiting, Ind		8-51	150	366	1	20		O						40	
Vermont American Furniture Corp	Orleans, Vt		7-51	150	Sat.	1	7	Bi	C, W							
Webber Hospital	Biddeford, Me	R. D. Kimball	1-51	150	Sat.	2	14	Bi	O							
Winslow Brothers & Smith	Bellows Falls, Vt		12-50	150	Sat.	1	10	Bi	O							
Jacques Wolf & Co	Carlstadt, N. J.		10-51	150	366	1	30	BW	O						55	
149 PSI AND BELOW																
Columbia Breweries, Inc	Tacoma, Wash	Lincoln Bouillon & Assoc	1951	135	Sat.	2	21.5	BW	O						43	
University of Louisville	Louisville, Ky	C. O. G. Wittig	7-51	135	Sat.	1	35	Vo	TG (111)						50	
Allis-Chalmers Mfg Co	La Porte, Ind	C. W. Cole & Sons		130	420	3	60	RS	TG							
Bangor State Hospital	Bangor, Me	N. U. Greenlaw	11-51	125	340	1	30	BW	O						50	
Edison Vocational High School	Baltimore, Md	Henry Adams, Inc	9-52	125	Sat.	3	16	EC	UF (60)						52	
Westvaco Chemical Div	Pocatello, Idaho	Becktel Corp	1952	125	Sat.	1	18	BW	O						50	
Food Machinery & Chemical Corp	Middleport, N. Y.	Zack Hinds	5-51	125	225	1	27	BW	SS						36	
Indiana State Teachers College	Terre Haute, Ind	T. Davis	1952	125	Sat.	2	45	Vo	TG (140)						90	
Memorial Hospital	Houston, Texas			125		3	17.3	CE	G						51.9	
Osborn Memorial Home	Harrison, N. Y.		8-51	125	Sat.	1	5.1	Bi	C							
Pepper Packing Co	Denver, Colo	Champion		125	362	1 1	33 14	Wi	G						47	
Perfection Stove Co	Cleveland, Ohio		1951	125	Sat.	3	30	CE	UF (108)						90	
Revere Copper & Brass, Inc	Rome, N. Y.	Robson & Woote	3-51	125		1	45		O						100	
St. Mary's Hospital	Pierre, S. D.		3-52	125	500	2	7	Bi	O							
The Seymour Mfg. Co	Seymour, Conn	Westcott & Mapes	1952	125	Sat.	3	13	Bi	O							
Stauffer Chemical Co	Niagara Falls, N. Y.	Singmaster & Breyer	12-51	125	Sat.	1	45	BW	SS						135	
Sun Oil Company	Newark, N. J.		12-51	125	Sat.	1	14	IB	C,O							
Victoria General Hospital	Halifax, N. S.	Engrg Service Co	1952	125	Sat.	1	50	FW	SS						66	
Amana Refrigeration, Inc	Amana, Iowa		11-51	120		1 3	11 10	Wi	O						16	
College of St. Thomas	St. Paul, Minn	W. J. Haskow	11-51	110	343	1 1	30 20	WB	O, G						50	
Eielson Air Force Base	Fairbanks, Alaska	Lincoln Bouillon & Assoc	1951	100		1	23	BW	O						60	
Gansevoort Destructor Plant	New York, N. Y.		1952	100	Sat.	1	4	Bi	O							
Joanna Cotton Mills Co	Joanna, S. C.	R. Thomas	12-51	100		2	16	EC	O						32	
Phoenix Insurance	Hartford, Conn		2-51	100	Sat.	3	9	Bi	O							
Municipal Tuberculosis Sanitorium	Chicago, Ill		1952			3	20	Wi	O, G							
Sherwin-Williams Co	Newark, N. J.					1	12	Wi	SS							
Erie Corrugated Box Co	Erie, Pa		8-51			1	12.8	EC								


Horsepower, millions, U.S. and Canada
Total installed horsepower in United States
Total installed horsepower in Canada
As of Dec 31st of each year

CAPACITY: Hydro in U.S. increased from 8,000,000 hp in 1920 to 30,750,000 in 1951; Canada, from 2,500,000 to 13,500,000


Kilowatt-hours generated, billions
Percent of total generated by steam and hydro
Total kilowatt hours generated by steam and hydro central stations
Generated in steam plants
Percent steam
Percent hydro
Generated in hydroelectric plants
Generated in publicly owned plants
As of Dec 31st of each year

POWER generated in U.S. steam, hydro central stations; kwhr each class of plant supplied; also percent total each provided

Hydro Continues Its Rapid Climb

During 1951, installed water-power capacity in the U.S. and Canada continued the rapid growth of the two preceding years.

U.S. Hydro. Over 1,600,000 hp went into service last year, bringing the total installed capacity to 30,750,000 hp, as the left-hand curves show. This development will continue for sometime, as a study of the tables on pp 98-101 discloses. Capacity of new plants and new units in old plants scheduled for operation in 1952 total over 2,500,000 hp. All of this will probably not go into service. But the total will be well over 2,000,000 hp, and 1953 will add another 1,500,000 hp.

Power Generation. Total output of public-utility plants increased to over 360 billion kwhr in 1951, a gain of nearly 13% over 1950. Because of this rapid growth of the total power load, water-power generation dropped to about 28% of the total. This is the lowest on record, as the curves at the right show.

Except in the New England, Middle Atlantic and East North Central states, federal government agencies do a large part of water-power development. Since 1932 construction has been started or completed on 100 of these projects. Their ultimate capacity is 21,500,000 hp, of which 11,250,000 hp is in operation and 6,200,000 on order, table, p 102.

Grand Coulee plant on the Columbia River was completed in 1951, with 18 main and 3 service units. Based on the normal loading of its main units, 125,000 kw, this plant has a capacity of 3,102,000 hp, by far the world's largest power plant, steam or hydro. On June 11, 1951, between 10 and 11 am, plant load was 2,018,000 kw, and for the year ending June 30, 1951, it generated nearly 13 billion kwhr.

New Records. Francis, propeller and kaplan turbines set new records last year. The two 48,000-hp francis turbines designed for 1045-ft head, being installed in Flatiron plant of Colorado-Big Thompson project, will operate under the highest head for their size and type. Static head will range from 1130-1000 ft.

Rated at 70,500 hp each, the kaplan and the three propeller turbines being installed in Cabinet Gorge plant of Washington Power Co are largest of their type to operate under 100-ft head. In fact, they will have about the world's greatest output for their type, as well as about the highest head.

Canada. Water-power development in Canada saw a banner year in 1951. Total generation, most of which was from hydro plants, for the first time passed 50 billion kwhr, reaching almost 55 billion. About 900,000 hp of new hydro capacity went into service, bringing the total to nearly 13,500,000 hp, as the lower curve on the left shows.

Late in 1950, U.S. and Canada ratified a treaty to use more water from Niagara River for power generation. Early in 1951, Hydro-Electric Power Commission of Ontario started work on a 1,200,000-hp over-all development of the Falls to use its share of the water. This project includes two concrete-lined tunnels, 5.5 miles long, 45-ft inside diameter, and twelve 100,000-hp units, seven of which are on order. First unit is scheduled for April 1954 operation. On the U.S. side, nothing has been done.

Aluminum Co of Canada began work on the world's largest aluminum-refining project (500,000 tons per yr) and largest high-head hydro-power development. This project is on the Frazer River's headwaters in northwest British Columbia, near Prince Rupert. Hydro plant will be underground in solid rock, designed for sixteen 150,000-hp 4-jet vertical-shaft impulse turbines at 2500-ft head. These units are the largest in the world to operate at so high a head. The plant's ultimate capacity (2,400,000 hp) is several times larger than any other for this head.

U. S. and Canadian Hydroelectric Plants Put

Compiled by F A Annett, Contributing Editor

Company or government agency	Design or consulting engineers	Project name	[1] Type of construction	River	State	Project started, date	[2] Dam type	Dam length, ft.	Dam height, ft.	Date of initial operation
NEW ENGLAND STATES										
Central Maine Power Co	New England Power Service Co	Williams	New	Kennebec	Me.	1937	CGG	340	35	1939
Central Vermont Public Serv Corp	NEPSCO Services & W. P. Creager	Weybridge	Red.	Otter Creek	Vt.	1950	CG	320	29	1951
Holyoke Water Power Co	Jackson & Moreland	No. 3 Station	Red.	Connecticut	Mass.	1949	GM	1,020	30	1951
Pinemush Mills		Taftville	Red.		Conn.	1949				1951
MIDDLE ATLANTIC STATES										
Niagara Mohawk Power Corp		Stewart Bridge	Red.	Sacandaga	N.Y.	1947	Earth	1,650	112	1952
Central Hudson Gas & Elec Corp	Chas T Main, Inc	Neversink	New	Neversink	N.Y.	1948	Earth	2,800	200	1952
Rochester Gas & Electric Corp	Rochester Gas & Elec Corp; Louis S Bernstein	Station 26A	Red.	Genesee	N.Y.	1951	SG			1952
Brownville Board Corp		Brownville	Red.		N.Y.	1949				1951
EAST NORTH CENTRAL STATES										
U. S. Corps of Engineers	U. S. Corps of Engineers; Erik Floor & Associates	St. Mary's Falls	New	St. Mary's	Mich.	1947				1951
Wisconsin-Michigan Power Co	Mead & Hunt, Inc	Michigamme Falls	New	Michigamme	Mich.	1951	CGE	1,421	52	1952
Wisconsin Michigan Power Co	Mead & Hunt, Inc	Hemlock Falls	New	Michigamme	Mich.	1951	CG&E			1952
Wisconsin Michigan Power Co	Mead & Hunt, Inc	Lower Paint Dam	New	Paint	Mich.	1951	CG&E	616	25	1952
City of Plainwell		Plainwell	New		Mich.	1951				1951
Stark Woodworking Co		Algona	New		Mich.	1951				1951
Utica Milling Co		Utica	Red.		Mich.	1951				1951
Nekoosa-Edwards Paper Co		Port Edwards	Red.		Wis.	1951				1951
Little Rapids Pulp Co		West DePere	Red.		Wis.	1951				1951
St. Anthony Falls Water Power Co			New		Minn.	1951				1952
WEST NORTH CENTRAL STATES										
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Angostura	New	Cheyenne	S.D.	1946	CG&EF	2,650	190	1951
U. S. Corps of Engineers	U. S. Corps of Eng; Chas T Main	Garrison	New	Missouri	N.D.	1947	Earth	12,000	210	1955
U. S. Corps of Engineers	U. S. Corps of Engineers; Eric Floor & Associates	Fort Randall	New	Missouri	S.D.	1946	Earth	10,000	160	1954
Union Electric Co of Missouri	Stone & Webster Engrg Corp	Bagnell Dam	New	Osage	Mo.	1930	CG	2,543	148	1931
SOUTH ATLANTIC STATES										
Solvay Process		South Point	New		Va.	1950				1951
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Buggs Island	New	Roanoke	Va. & N.C.	1947	CG	22,357	144	1952
U. S. Corps of Engineers	U. S. Corps of Engineers	Philpott	New	Smith	Va.	1948	CG	920	270	1951
Nantahala Power & Light Co	Aluminum Co of America	Cedar Cliff	New	E Fk Tuckasegee	N.C.	1950	R&EF	579	117	1952
The English Mica Co		Spruce Pine	New		N.C.	1951				1951
So. Carolina Electric & Gas Co	Company's Engineering Staff	Columbia	Red.	Broad	S.C.	1950	RFTC	1,000	14	1952
Simsco Products Co		Hartsville	Red.		S.C.	1951				1951
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Clark Hill	New	Savannah	S.C.&Ga.	1947	CG	5,660	200	1953
U. S. Corps of Engineers	U. S. Corps of Engineers; Eric Floor & Associates	Buford	New	Chattahoochee	Ga.	1949	Earth	1,630	195	1955
Georgia Power Co	Southern Services, Inc; S H Woodward	Furman Shoals	New	Oconee	Ga.	1950	CG&EF	2,732	102	1952
Georgia Power Co	Stone & Webster; Chas T Main, Inc	Bartlett's Ferry	New	Chattahoochee	Ga.	1924	CG&EF	2,080	147	1926
U. S. Corps of Engineers	U. S. Corps of Engineers	Jim Woodruff	New	Chattahoochee	Fla.	1949	CG&EF	6,084	107	1953
EAST SOUTH CENTRAL										
Alabama Power Co		Martin Dam	New	Tallapoosa	Ala.	1923	CG	1,277	168	1926
Tennessee Valley Authority	Tennessee Valley Authority	Pickwick Landing	New	Tennessee	Tenn.	1935	CG&E	7,715	113	1938
Tennessee Valley Authority	Tennessee Valley Authority	Guntersville	New	Tennessee	Ala.	1935	CG	3,985	94	1940
Tennessee Valley Authority	New extension; Tennessee Valley Authority	Hales Bar	New	Tennessee	Tenn.	1905	CG	2,315	112	1913-15
Tennessee Valley Authority	Tennessee Valley Authority	Chickamauga	New	Tennessee	Tenn.	1936	CG	5,794	108	1940
Tennessee Valley Authority	Tennessee Valley Authority	Boone	New	S Fk Holston	Tenn.	1950	CG	1,330	140	1952
Tennessee Valley Authority	Tennessee Valley Authority	Fontana	New	Little Tenn.	N. C.	1942	CG	2,365	480	1945
Tennessee Valley Authority	Tennessee Valley Authority	Cherokee	New	Holston	Tenn.	1940	CG&EF	6,760	175	1942
Tennessee Valley Authority	New extension, TVA	Ocoee No. 2	Red.	Ocoee	Tenn.	1912	CRF	450	30	1912
U. S. Corps of Engineers	U. S. Corps of Engrs; Chas T Main	Dale Hollow	New	Obey	Tenn.	1942	CG	1,717	185	1948
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Center Hill	New	Caney Fork	Tenn.	1942	CG&E	2,160	240	1951
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Wolf Creek	New	Cumberland	Ky.	1942	CG&E	5,736	240	1952
U. S. Corps of Engineers	U. S. Corps of Engineers; Ambursen Engineering Corp	Old Hickory	New	Cumberland	Tenn.		RC			
WEST CENTRAL STATES										
U. S. Corps of Engineers	U. S. Corps of Engineers; L. H Harza Engineering	Blakely Mountain	New	Ouachita	Ark.	1948	Earth	1,150	230	1954
U. S. Corps of Engineers	U. S. Corps of Engineers; Chas T Main, Inc	Bull Shoals	New	White	Ark.	1947	CG	2,256	284	1953
Grand River Dam Authority	Holway & Neuffer	Pensacola Dam	New	Grand	Okla.	1938	MA	6,100	150	1941
U. S. Corps of Engineers	U. S. Corps of Engrs; Fargo Eng Co	Fort Gibson	New	Grand	Okla.	1946	CG&E	2,850	110	1953
U. S. Corps of Engineers	U. S. Corps of Engineers	Tenkiller Ferry	New	Illinois	Okla.	1948	R&E	3,000	155	1953
City of Tulsa		Spavinaw Dam	New		Okla.	1950				1951
Lower Colorado River Authority	Fargo Engineering Co	Granite Shoals	New	Colorado	Texas	1949	CG&EF	765	105	1952
Lower Colorado River Authority	Fargo Engineering Co	Marble Falls	New	Colorado	Texas	1949	CG	820	80	1952
U. S. Corps of Engineers	U. S. Corps of Engineers; Ambursen Engineering Corp	Whitney Dam	New	Brazos	Texas	1946	CG&EF	17,801	163	1952
Int Boundry & Water Commission of United States and Mexico	R J Tipton, J L Burkholder, Walker Young & U. S. Bureau of Reclamation	[4] Falcon Dam	New	Rio Grande	Mexico; Texas	1950	EF	26,264	150	1953

in Operation or Under Construction 1951

Initial capacity, hp	Added capacity, no. of units	Date of added capacity	Ultimate capacity, hp	No. units installed	Nameplate capacity, hp	Turbine type	Speed, rpm	Static head, ft	Design head, ft	Turbine manufacturer	Turbine controlled	Speed cont. governor or hand	Penstock valve, type	Generator capacity, kva	Excitation, automatic or manual	Powerhouse location	Design year	Kilowatts	Cycles	Generator manufacturer
10,150	1	1951	18,950	1	10,150	Kaplan	150	44	44	MS	W	Concrete	Head gt	8,000	Manual	AG	0.88	6.9	60	GE
				1	8,800	Kaplan	171.4	44	44	MS	W	Concrete	Head gt	6,500	Manual	AG	0.93	6.9	60	GE
670	1	1951	4,170	1	3,500	Kaplan	138.5	31-25	31	MS	W	Concrete	Head gt	3,000	Automatic	AG	0.80	4.16	60	WE
22,000		.....	88,000	1	22,000	Kaplan	128.5	52.5	52.5	MS	W	Concrete	Head gt	18,750	Auto. or man.	AG	0.80	13.8	60	GE
1,300		.....	1,300	?	650	Francis	225	27	27	JL	W	Concrete	Head gt	438	Manual	AG	0.80	2.4	60	WE
42,500	..	.....	42,500	1	42,500	Francis	105.9	100	97	BL	...	.....	Head gt	37,500	Manual	BG	0.80	13.8	60	GE
41,000	..	.....	41,000	1	41,000	Francis	300	551-463	474	NN	W	Cast St	Butterfly	31,250	Manual	AG	0.83	13.8	60	GE
5,000	..	.....	5,000	1	5,000	Kaplan	150	25	25	AC	W	Plate St	Head Gt	4,500	Manual	AG	0.80	4.4	60	AC
451	..	.....	451	1	451	Francis	145	20	20	JL	...	Concrete	Head gt	Drives mill machinery						
23,925	..	.....	72,750	3	6,975	Propeller	80	23-18	21	AC	W	Concrete	Head gt	5,333	Manual	BG	0.90	13.8	60	GE
				1	3,000	Kaplan	128.5	23-19	21	MS	W	Concrete	Head gt	2,500	Manual	BG	0.90	4.16	60	GE
13,000	..	.....	13,000	2	6,500	Francis	277	60	60	AC	W	Concrete	Head gt	5,333	Automatic	AG	0.90	4.8	60	AC
3,800	..	.....	3,800	1	3,800	Kaplan	200	34	34	AC	W	Concrete	Head gt	3,111	Automatic	AG	0.90	4.16	60	AC
155	..	.....	155	1	155	Francis	514	20	21	AC	...	Open Flume	Head gt	100	Induction generator	.....		0.48	60	AC
140	..	.....	140	1	140	Francis	130	12	12	JL	...	Concrete	Head gt	Drives pumps						
86	..	.....	86	1	86	Francis	386	22	22	JL	...	Concrete	Head gt	Drives mill machinery						
115	..	.....	115	1	115	Francis	423	27	27	JL	...	Concrete	Head gt	Drives mill machinery						
1,000	..	.....	1,000	1	1,000	Francis	240	22	22	JL	...	Concrete	Head gt	Connects to existing generator						
288	..	.....	288	2	144	Francis	69	7	7	JL	...	Concrete	Head gt	Drives mill machinery						
11,680	..	.....	11,680	10	1,168	Francis	225	24	24	JL	...	Concrete	Head gt	875	Manual	AG	0.80	4.11	60	EM
1,675	..	.....	1,675	1	1,675	Francis	514	133-93	104	JL	W	Cast iron	Butterfly	1,333	Manual	AG	0.90	2.4	60	IE
264,000	..	.....	440,000	3	88,000	Francis	90	187-100	150	BL	...	Plate st	Head gt	84,210	Manual	BG	0.95	13.8	60	GE
230,000	..	.....	460,000	4	57,500	Francis	87.5	145-76	112	AC	...	Plate st	Head gt	42,100	Manual	BG	0.95	13.8	60	WE
207,050			274,050	6	33,500	Francis	112.5	94	90	AC	AC	Plate st	Head gt	23,888	Manual	BG	0.9	13.8	60	WE
				2	3,025	Francis	327	94	90	AC	AC	Plate st	Head gt	3,000	Manual	AG	1.70	2.4	60	WE
	2	1953	.....	2	33,500	Francis	112.5	94	90	AC	AC	Plate st	Head gt	23,888	Manual	BG	0.9	13.8	60	WE
3,200	..	.....	3,200	4	800	Impulse	900	.....	.....	BL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
175,200	..	.....	328,200	3	51,000	Francis	85.7	108-60	90	NN	W	Plate st	Head gt	35,555	Manual	BG	0.90	13.8	60	WE
				3	19,000	Francis	138.5	108-60	90	BL	W	Plate st	Head gt	13,333	Manual	BG	0.90	13.8	60	WE
				2	1,600	Francis	450	108-60	90	JL	W	Service unit	Head gt	1,250	Manual	AG	0.80	0.48	60	WE
20,140	..	.....	20,140	2	9,640	Francis	277	177-108	152	JL	W	Plate st	Head gt	7,500	Manual	AG	0.90	13.8	60	GE
				1	840	Francis	720	177-109	152	JL	W	Service unit	Head gt	750	Manual	AG	0.80	0.48	60	GE
9,400	..	.....	9,400	1	9,400	Francis	360	172-168	170	MS	W	Plate st	Head gt	7,500	Automatic	AG	0.85	6.6	60	EM
135	..	.....	135	1	135	Francis	141	12	12	JL	...	Concrete	Head gt	Drives mill machinery						
3,000	..	.....	3,000	2	1,500	Francis	164	36-27	25	JL	W	Plate st	Head gt	1,525	Manual	HS	0.80	4.8	60	WE
220	..	.....	220	1	220	Francis	150	10	10	JL	...	Concrete	Head gt	Drives existing GE generator						
380,600	..	.....	388,600	7	55,000	Francis	100	150-111	135	NN	AC	Plate st	Head gt	44,444	Manual	BG	0.90	13.8	60	GE
				2	1,800	Francis	600	150-111	135	JL	W	Plate st	Head gt	1,250	Manual	AG	0.80	0.48	60	GE
118,400	..	.....	118,400	2	55,000	Francis	100	150-103	136	...	...	Plate st	Head gt	44,444	Manual	BG	0.90	13.8	60	...
				1	8,400	Francis	277	150-103	136	...	...	Plate st	Head gt	6,667	Manual	BG	0.90	13.8	60	...
60,000	..	.....	60,000	2	30,000	Francis	105.9	92-72	85	MS	W	Concrete	Head gt	25,000	Manual	BG	0.80	6.9	60	GE
66,000	1	1951	94,500	3	22,000	Francis	150	117-87	112	2 MS, 1 AC	W	Plate st	Head gt	18,750	Manual	AG	0.80	12.0	60	2WE
				1	28,500	Francis	150	117-87	112	MS	W	Plate st	Head gt	25,000	Manual	AG	0.80	6.9	60	2GE
42,000	..	.....	42,000	3	14,000	Kaplan	75	32-14	26.5	NN	W	Concrete	Head gt	11,111	Manual	BG	0.90	13.8	60	WE
135,000	1	1952	213,000	3	45,000	Francis	120	146-86	.....	1NN, 2AC	W	Plate st	Head gt	37,500	Manual	AG	0.88	12.00	60	GE
				1	78,000	Francis	112.5	146-86	145	MS	W	Plate st	Head gt	60,000	Manual	BG	0.80	12.0	60	GE
96,000	2	1952	302,000	4	48,000	Kaplan	81.8	63-29	47	AC	AC	Concrete	Head gt	40,000	Manual	BG	0.90	13.8	60	WE
	2	1951		2	55,000	Kaplan	81.8	63-29	47	AC	AC	Concrete	Head gt	40,000	Manual	BG	0.90	13.8	60	WE
102,000	1	1961	141,000	3	34,000	Kaplan	68.2	42	42	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
				1	39,000	Kaplan	68.2	42	42	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
86,000	2	1952	140,000	8	7,700	Francis	112.5	37.5	137.5	MS	...	Plate st	Head gt	6,500	Automatic	AG	1.00	6.6	60	GE
				2	4,200	Francis	112.5	37.5	37.5	MS	...	Plate st	Head gt	3,750	Automatic	AG	0.80	6.6	60	GE
				4	4,100	Francis	100	37.5	37.5	MS	...	Plate st	Head gt	3,133	Automatic	AG	0.80	6.6	60	GE
				2	34,000	Kaplan	68.2	37.5	37.5	MS	W	Concrete	Head gt	27,000	Manual	BG	0.90	13.8	60	GE
108,000	1	1951	144,000	4	36,000	Kaplan	75	36	36	BL	W	Concrete	Head gt	30,000	Manual	BG	0.90	13.8	60	AC
103,500			103,500	3	34,500	Francis	100	124-36	90	NN	W	Concrete	Head gt	31,250	Manual	BG	0.80	13.8	60	WE
183,000	1	1952	274,500	3	91,500	Francis	150	429-244	330	AC	AC	Plate st	Head gt	75,000	Manual	BG	0.90	13.8	60	WE
83,000	1	1952	166,000	3	41,500	Francis	100	149-55	100	MS	W	Plate st	Head gt	33,333	Manual	BG	0.90	13.8	60	GE
20,000	1	1951	25,000	1	15,000	Francis	360	255-235	250	WS	AC	Cast iron	Butterfly	13,125	Manual	HS	0.80	6.6	60	EC
				1	10,000	Francis	360	255-235	250	IM	AC	Cast iron	Butterfly	11,750	Manual	HS	0.80	6.6	60	GE
50,000	1	1951	75,000	3	25,000	Francis	163.6	154-118	140	MS	W	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	WE
188,750	..	.....	188,750	3	62,500	Francis	105.9	206-134	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
				1	1,250	Francis	720	206-134	160	MS	W	Service unit	.....	1,000	Manual	AG	0.80	0.48	60	EC
377,000	..	.....	377,000	6	62,500	Francis	105.9	214-111	160	BL	W	Plate st	Head gt	50,000	Manual	BG	0.90	13.8	60	GE
				1	2,000	Francis	600	214-111	160	JL	W	Service unit	.....	1,500	Manual	AG	0.80	0.48	60	EC
180,000	..	.....	180,000	4	45,000	Kaplan	75	60-45	52	BL	...	Concrete	Head gt	36,000	Manual	BG	0.80	13.8	60	GE
106,000	..	.....	106,000	2	53,000	Francis	120	186-135	160	MS	W	Plate st	Butterfly	41,667	Manual	BG	0.90	13.8	60	WE
211,000	..	.....	211,000	4	52,000	Francis	128.6	239-132	190	AC	W	Welded pl st	Head gt	42,100	Manual	BG	0.90	13.8	60	AC
				2	1,500	Francis	600	239-132	190	JL	W	Service unit	Head gt	1,250	Manual	AG	0.80	0.48	60	GE
80,000	5	1941-5	120,750	6	20,000	Francis	150	135-85	115	AC	W	Plate st	Head gt	16,000	Manual	BG	0.90	12.0	60	WE
	1	1951		1	750	Francis	720	135-85	115	AC	W	Cast st	Service unit	625	Manual	HS	0.80	0.48	60	WE
64,000	..	.....	96,000	4	16,000	Francis	100	90-56	61	BL	W	Concrete	Head gt	12,500	Auto. or man.	BG	0.90	13.8	60	AC
47,000	..	.....	47,000	2	23,500	Francis	150	181-104	132	MS	W	Plate st	Butterfly	18,000	Manual	BG	0.90	13.8	60	EC
150	..	.....	150	1	150	Francis	900	75	75	JL	..	Concrete	Head gt	125	Manual	HS	0.80	0.48	60	WE
66,000	..	.....	66,000	2	33,000	Francis	100	83	83	BL	W	Plate st	Head gt	25,000	Auto. or man.	BG	0.80	13.8	60	GE
42,000	..	.....	42,000	2	21,000	Propeller	120	57	57	MS	W	Concrete	Head gt	16,666	Auto. or man.	BG	0.90	6.9	60	WE
41,000	..	.....	41,400	2	20,700	Francis	128.5	126-78	91.5	NN	W	Plate st	Head gt	16,667	Manual	BG	0.90	13.8	60	AC
88,500	..	.....	118,000	6	14,750	Francis	164	124-66	100	AC	W	Plate st	Head gt & Butterfly	11,667	Auto. or man.	AG	0.90	6.9	60	GE

U. S. and Canadian Hydroelectric Plants Put

Compiled by F A Annett, Contributing Editor

Company or government agency	Design or consulting engineers	Project name	[1]New or redeveloped	River	State	Project started, date	[2]Dam type	Const. length, feet	Max. height, feet	Date of initial operation
MOUNTAIN STATES										
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Davis Dam	New	Colorado	Ariz.& Nev.	1941	R&E	1,600	135	1951
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Mary's Lake	New	Colo. Big Thompson	Colo.	1947	.....	.....	.....	1951
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Pole Hill	New	Colo. Big Thompson	Colo.	1950	.....	.....	.....	1953
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Flatiron	New	Colo. Big Thompson	Colo.	1951	.....	.....	.....	1953
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Boysen	New	Big Horn	Wyo.	1947	EF	1,000	150	1952
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Alcova	New	North Platte	Wyo.	.....	EF	763	265	1954
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Canyon Ferry	New	Missouri	Mont.	1949	CG	1,000	220	1953
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Hungry Horse	New	So. Fk. Flathead	Mont.	1948	CA	2,100	520	1952
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Anderson Ranch	New	Boise	Idaho	1941	EF	1,350	330	1951
Corps of Engineers	Swendrup & Parcel, Inc	Albeni Falls	New	Pend Oreile	Idaho	1950	CG	755	83	1954
Idaho Power Co	Ebasco Services, Inc	C J Strike	New	Snake	Idaho	1950	EF	9,000	120	1951
Washington Water Power Co	Ebasco Services, Inc	Cabinet Gorge	New	Clark Fork	Idaho	1951	CA	320	170	1952
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	American Falls	New	Snake	Idaho	.....	CG	5,227	94	1953
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Palisades	New	Snake	Idaho	.....	EF	2,800	260	1955
PACIFIC COAST STATES										
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Grand Coulee	New	Columbia	Wash.	1934	CG	4,500	553	1941
U. S. Corps of Engineers	U. S. Corps of Engineers	Chief Joseph	New	Columbia	Wash.	1949	CG	2,160	220	1955
City of Seattle, Dept of Ltg	Dr J L Savage	Ross Dam	New	Skagit	Wash.	1937	CA	1,300	540	1952
City of Seattle, Dept of Ltg	Dr J L Savage	Gorge	Red.	Skagit	Wash.	1948	CG	180	33	1951
City of Tacoma, Lighting Div	Lighting Div Engr Staff	Cushman No. 2	New	Skokomish	Wash.	.....	.....	.....	.....	.....
U. S. Corps of Engineers	U. S. Corps of Engineers	McNary Dam	New	Columbia	Wash. & Ore.	1947	CG&EF	8,800	150	1954
U. S. Corps of Engineers	U. S. Corps of Engineers	Detroit	New	North Santiam	Ore.	1949	CG	1,580	450	1953
U. S. Corps of Engineers	U. S. Corps of Engineers	Big Cliff	New	North Santiam	Ore.	1950	CG	295	172	1953
Portland General Electric Co	Portland General Electric Co	Station M	Red.	Clackamas	Ore.	1909	.....	414	90	1911
Portland General Electric Co	Ebasco Services & Geo T M Robbins	Pelton	New	Deschutes	Ore.	1951	CA	560	185	1953
California Oregon Power Co	Pioneer Service & Engr Co	Soda Springs	New	North Umpqua	Ore.	1949	CA	100	70	1951
California Oregon Power Co	Pioneer Service & Engr Co	Slide Creek	New	North Umpqua	Ore.	1949	CG	100	20	1951
California Oregon Power Co	Pioneer Service & Engr Co	Fish Creek	New	Fish Creek	Ore.	1951	RFTC	215	31	1952
California Oregon Power Co	Pioneer Service & Engr Co	Clearwater No. 1	New	Clearwater	Ore.	1951	EF	384	30	1952
California Oregon Power Co	Pioneer Service & Engr Co	Clearwater No. 2	New	Clearwater	Ore.	1951	RFTC	157	26	1953
U. S. Bureau of Reclamation	U. S. Corps of Engineers U. S. Bureau of Reclamation	Folsom	New	American	Calif.	.....	C&EF	12,000	340	1954
Pacific Gas & Electric Co	Pacific Gas & Electric Co	Bear River	New	Bear	Calif.	1950	RF	960	235	1953
Southern Calif. Edison Co	International Engineering Co Rechtel Corp-Morrison-Knudsen Co	Big Creek No. 4	New	San Joaquin	Calif.	1949	CG	945	228	1951
Dept of Water & Power, City of Los Angeles	F J Converse, Chas T Leeds Chester Mailliave, C R Rankine & Dept's Power System Engrs	Owens Gorge No. 1 Owens Gorge No. 2 Owens Gorge No. 3	New	Owens	Calif.	1948	.....	.....	.....	1951
Imperial Irrigation District	Gibbs & Hill, Inc	Drop No. 2	New	All American Canal	Calif.	1952	.....	.....	.....	1953
ALASKA										
U. S. Bureau of Reclamation	U. S. Bureau of Reclamation	Eklutna	New	Lake Eklutna	Alaska	.....	EF	.....	.....	.....
CANADA					Province					
Newfoundland Lt & Pr Co	Montreal Engineering Co	Mobile	New	Mobile	N.F.	1949	CG	250	5	1951
Avon River Power Co	Montreal Engineering Co	White Rock	Red.	Gaspereau	N.S.	1951	CG	.....	.....	1952
Nova Scotia Power Commission	.....	Gulch	New	Bear	N.S.	1950	.....	.....	.....	1952
Maine & New Brunswick Pr Co	.....	Tusket	New	Aroostook	N.B.	1950	.....	.....	.....	1952
New Brunswick Power Comm	Power Corp of Canada	Tobique Narrows	New	Tobique	N.B.	1950	CG	350	80	1953
Northern Quebec Power Co	Power Corp of Canada	Quinze	New	Ottawa	Que.	1927	S&RF	2,500	60	1923
Quebec Hydro-Elec Commission	.....	Beauharnois No. 1	New	St. Lawrence	Que.	1929	P&G	4,500	31	1932
Quebec Hydro-Elec Commission	H G Acres Co	Beauharnois No. 2	New	St. Lawrence	Que.	1948	P&G	4,500	31	1951
Shawinigan Water & Power Co	Shawinigan Engineering Co	Trenche	New	St. Maurice	Que.	1946	CG	.....	.....	1950
Electrique de Mont Laurier	.....	.....	New	Lievre	Que.	1948	.....	.....	.....	1951
Aluminum Co of Canada, Ltd	Shawinigan Engineering Co	Chute du Diable	New	Peribonka	Que.	1950	CG	1,390	100	1952
Aluminum Co of Canada, Ltd	Shawinigan Engineering Co	Chute a la Savine	New	Peribonka	Que.	1951	CG	1,340	100	1953
Wawcoungon Power Co	H G Acres & Co	McCormick Dam	New	Mamcougan	Que.	1951	CG	4,575	95	1952
Gulf Power Co	Stadler, Harter & Co	Marguerite River	New	Marguerite	Que.	1951	CG	450	120	1954
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Sir Adam Beck-Niagara No. 2	New	Niagara	Ont.	1950	.....	.....	.....	1954
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	La Cave	New	Ottawa	Ont. & Que.	1948	CBS	2,500	130	1952
Hydro-Elec Power Comm of Ont	Hydro-Elec Power Comm of Ont	Des Joachims	New	Ottawa	Ont. & Que.	1947	CG	5,500	165	1950
Hydro-Elec Power Comm of Ont	H G Acres Co	Chenaux	New	Ottawa	Ont. & Que.	1948	CG	4,000	70	1950
Pembroke Electric Co	H G Acres Co	Waltham	Red.	Black	Que.	1940	RFTC	750	30	1941
Great Lakes Power Co	Hazza Engineering Co	Scott Falls	New	Michipicoten	Ont.	1950	E&C	980	90	1952
Great Lakes Power Co	Hazza Engineering Co	Moon Creek	New	Michipicoten	Ont.	1951	E&C	620	70	1954
Winnipeg Electric Co	Power Corp. of Canada Winnipeg Elec Co Engrg Staff	Seven Sisters	New	Winnipeg	Man.	1929	CG	620	80	1931
Manitoba Dept of Mines & Res	H G Acres & Co; Dr T H Hogg	Pine Falls	New	Winnipeg	Man.	1948	CG	910	65	1951
Sherritt Gordon Mines, Ltd	H G Acres & Co	Laurie River	New	Laurie	Man.	1951	CG	820	73	1952
Calgary Power Co	Montreal Engineering Co	Three Sisters	New	Goat Creek	Alta.	1948	EF	2,000	50	1951
Calgary Power Co	Montreal Engineering Co	Kananaskis Ext	New	Bow	Alta.	1950	.....	.....	.....	1951
Calgary Power Co	Montreal Engineering Co	Rundle	New	Bow	Alta.	1950	.....	.....	.....	1951
Northwest Territories Power Comm	.....	Mayo River	New	Mayo	Yukon	1951	RE	400	110	1952
British Columbia Electric Co	British Columbia Electric Co	Lake Buntzen No. 1	Red.	Coquitlam	B.C.	1950	CG	250	47	1951
British Columbia Electric Co.	B. C. International Engrg Co British Columbia Elec Co Swan, Rhoden & Wooster	Wahleach Lake	New	Wahleach Lake	B.C.	1950	EF	1,400	55	1952
British Columbia Power Comm	H G Acres Co	John Hart	New	Campbell	B.C.	1945	CG	2,900	140	1949
British Columbia Power Comm	B.C. Power Comm Staff, H G Acres & Co	Whatshan	New	Whatshan	B.C.	1948	.....	.....	.....	1951
British Columbia Power Comm	B. C. Power Comm	Clowhom Falls	New	Clowhom	B.C.	1950	CG	160	70	1952

U. S. and Canada Hydro Tables

[1]The term "New" applies to a new project on a site not developed before. "Redeveloped" indicates a project on a site that has been developed before and now has new wheels, settings and generators, or a new plant.

[2]CG, concrete gravity; CA, concrete arch; CG & EF, concrete gravity and earth fill; CGG, concrete gravity with gates; E & C earth and concrete, EF earth fill; GM, granite masonry; MA, multiple arch; P & E, piers and gates; RC, reinforced concrete; R & E, rock and earth fill; RFTC, rock-filled timber crib; SG, sector gates; S & RF, sluiceway and rock fill.

[3]AC – Allis-Chalmers Mfg Co
BL – Baldwin-Lima-Hamilton Corp
CAC – Canadian Allis-Chalmers, Ltd
CVL – Canadian Vickers, Ltd
DEW – Dominion Engineering Works, Ltd
IM – I P Morris
JL – James Leffel & Co
JIC – John Inglis Co, Ltd
NS – S Morgan Smith Co
NSC – S Morgan Smith Co, Canada, Ltd
NN – Newport News Shipbuilding & Dry Dock Co

in Operation or Under Construction in 1951

Initial capacity, hp	Added capacity, no. of units	Date of added capacity	Ultimate capacity, hp	No. units installed	Abandoned capacity, hp	Abandoned type	Speed, rpm	Static head, ft	Design head, ft	*Abandoned installation	*Contract number	Scroll case, steel or concrete	Runner type	Runner data, Type	Governor, manufacturer or licensee	*Powerhouse location	Design power factor	Kilowatts	Cycles	Generator manufacturer
312,500	..	.....	312,500	5	62,500	Francis	94.7	147-100	127	BL	W	Plate st	Head gt	45,000	Auto. or man.	AG	1.00	13.8	60	GE
11,300	..	.....	11,300	1	11,300	Francis	327	217-207	212	NW	W	Plate st	Head gt	9,000	Automatic	AG	0.90	6.9	60	GE
47,500	..	.....	47,500	1	47,500	Francis	450	850-810	815	PW	W	Cast st	Head gt	35,000	Automatic	AG	0.95	13.8	60	EC
96,000	..	.....	96,000	2	48,000	Francis	514	1130-1000	1045	PW	W	Cast steel	.....	35,000	Auto. or man.	AG	0.90	13.8	60	WE
21,000	..	.....	21,000	2	10,500	Francis	180	112-70	96	NW	W	.....	.....	8,333	Manual	AG	0.90	6.9	60	WE
53,000	..	.....	53,000	2	26,500	Francis	163.6	165-143	155	NW	W	Plate st	Butterfly	18,950	Manual	AG	0.95	6.9	60	EC
70,500	..	.....	70,500	3	23,500	Francis	150	160-80	125	NW	W	Plate st	Head gt	16,667	Manual	BG	1.00	6.9	60	GE
420,000	..	.....	420,000	4	105,000	Francis	180	485-262	400	AC	W	Welded pl st	Head gt	75,000	Auto. or man.	AG	1.00	6.9	60	GE
37,000	..	.....	55,500	2	18,500	Francis	277	330-173	260	JL	W	Cast st	Butterfly	15,000	Manual	AG	1.00	6.9	60	WE
58,800	..	.....	58,800	3	19,600	Kaplan	54.5	33-8	27	BL	..	Concrete	Head gt	15,778	Manual	BG	0.90	13.8	60	GE
114,000	..	.....	114,000	3	38,000	Propeller	138.5	88	88	NW	W	Concrete	Head gt	30,000	Manual	BG	0.92	13.8	60	GE
282,000	..	.....	282,000	3	70,500	Propeller	120	100-85	99	BL	W	Plate st	Head gt	55,555	Manual	BG	0.90	13.8	60	WE
				1	70,500	Kaplan	120	100-85	99	BL	W	Plate st	Head gt	55,555	Manual	BG	0.90	13.8	60	WE
42,000	..	.....	42,000	3	14,000	Francis	150	107-50	82	...	...	Plate st	Head gt	11,000	Manual	AG	0.90	6.9	60	...
117,900	..	.....	157,200	3	39,300	Francis	163.6	245-123	190	...	...	Plate st	Butterfly	29,600	Automatic	AG	0.95	6.9	60	...
538,000	9	1949-51	3,102,000	9	170,000	Francis	120	368	300	NW	W	Cast st	Head gt	125,000	Auto. or man.	AG	1.00	13.8	60	WE
				3	14,000	Francis	400	368	300	PW	W	Service unit	Head gt	10,000	Auto. or man.	AG	0.90	2.4	60	WE
				9	170,000	Francis	120	368	300	NW	W	Cast st	Head gt	125,000	Auto. or man.	AG	1.00	13.8	60	WE
1,600,000	..	.....	2,700,000	16	100,000	Francis	100	179-148	165	NW	...	Plate st	Head gt	67,368	Manual	BG	0.95	13.8	60	WE
360,000	..	.....	480,000	3	120,000	Francis	150	.....	355	BL	...	Welded pl st	Butterfly	100,000	Auto. or man.	AG	0.90	13.8	60	WE
92,500	..	.....	92,500	1	92,500	Francis	164	375-240	335	AC	W	Welded pl st	Butterfly	66,700	Manual	BG	0.90	11.00	60	WE
75,000	1	1952	112,500	3	37,500	Francis	300	484-450	440	AC	AC	Cast st	Butterfly	30,000	Manual	AG	0.90	12.6	60	AC
899,400	..	.....	1,567,200	II	111,300	Kaplan	87.5	92-65	80	MS	AC	Concrete	Head gt	73,684	Manual	BG	0.95	13.8	60	GE
				2	4,500	Francis	27.7	92-65	80	PW	W	Concrete	Head gt	3,750	Manual	BG	0.80	4.16	60	EM
140,000	..	.....	140,000	2	70,000	Francis	163.6	375-225	290	BL	W	Plate st	Head gt	55,555	Manual	BG	0.90	13.8	60	WE
26,500	..	.....	26,500	1	26,500	Francis	163.6	98-73	91	BL	W	Plate st	Head gt	20,000	Manual	BG	0.90	13.8	60	WE
25,725	1	1952	32,550	1	6,825	Francis	300	85-80	81	MS	W	Plate st	Head gt	5,000	Manual	HS	1.00	11.00	60	GE
156,000	..	.....	156,000	3	52,000	Francis	128.5	150	150	PW	W	.....	.....	40,000	Manual	...	0.90	13.8	60	GE
16,000	..	.....	16,000	1	16,000	Francis	164	107	107	AC	W	Plate st	Head gt	12,941	Automatic	AG	0.85	6.9	60	GE
25,000	..	.....	25,000	1	25,000	Francis	200	169	169	AC	W	Plate st	Head gt	21,176	Automatic	AG	0.85	6.9	60	GE
15,400	..	.....	15,400	1	15,400	Impulse	400	1034	995	PW	PW	.....	Butterfly	12,941	Automatic	HS	0.85	6.9	60	GE
21,000	..	.....	21,000	1	21,000	Francis	514	661-620	634	MS	W	Welded pl st	Butterfly	17,647	Automatic	AG	0.85	7.2	60	WE
36,000	..	.....	36,000	1	36,000	Francis	450	750-745	742	MS	W	Steel	Butterfly	30,588	Automatic	AG	0.85	11.5	60	GE
225,000	..	.....	225,000	II	75,000	Francis	163.6	340-145	300	NW	...	Plate st	Head gt	60,000	Manual	AG	0.90	13.8	60	WE
13,500	1	1953	53,500	I	40,000	Impulse	400	2068-1893	1960	PW	PW	.....	Spherical	33,000	Manual	AG	0.90	11.5	60	GE
115,550	..	.....	115,550	II	57,500	Francis	257	420-362	383	PW	W	Welded pl st	Butterfly	42,000	Auto. or man.	AG	1.00	11.5	1AC,	IGE
				1	550	Francis	1200	420-362	383	JL	W	Plate st	.....	400	Manual	AG	0.80	0.18	60	EC
				1	51,200	Francis	400	820	743	PW	W	Cast st	Plug	37,500	Automatic	AG	1.00	11.5	60	WE
153,600	..	1951	153,600	1	51,200	Francis	400	90	743	PW	W	Cast st	Plug	37,500	Automatic	AG	1.00	11.5	60	WE
				1	51,200	Francis	400	90	743	PW	W	Cast st	Plug	37,500	Automatic	AG	1.00	11.5	60	WE
15,000	..	.....	15,000	2	7,500	Kaplan	100	25.5	25.5	BL	W	Concrete	Head gt	6,250	.....	BG	0.80	6.9	60	GE
50,000	..	.....	50,000	2	25,000	Francis	600	870-788	800	...	W	Cast st	Butterfly	16,667	Manual	AG	0.90	6.9	60	...
13,000	..	.....	13,000	1	13,000	Francis	514	380-369	370	DEW	W	Welded pl st	Butterfly	11,000	Auto. or man.	AG	0.85	6.9	60	CWC
4,000	..	.....	4,000	1	4,000	Francis	200	65-60	60	CVL	W	Welded pl st	Head gt	4,000	Automatic	AG	0.80	6.9	60	CWC
8,500	..	.....	8,500	1	8,500	Francis	.....	250	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5,000	..	.....	5,000	1	5,000	Francis	300	85	85	MSC	W	Concrete	Head gt	4,400	Manual	AG	0.80	12.0	60	CWC
27,000	..	.....	27,000	2	13,500	Kaplan	225	80-66	75	MSC	W	Concrete	Head gt	12,500	Manual	AG	0.80	6.9	60	CGE
	2	1929	119,000	2	10,000	Francis	187	70-90	70	DEW	...	Plate st	Head gt	10,000	Manual	AG	0.80	11.0	25	SEC
20,000	1	1951	.....	2	10,000	Francis	187	70-90	70	DEW	...	Plate st	Head gt	10,000	Manual	AG	0.80	11.0	25	SEC
				1	35,000	Francis	107	70-90	90	CAC	W	Welded pl st	Head gt	32,500	Manual	AG	0.80	11.0	25	CGE
				4	53,000	Francis	75	82-75	80	DEW	DEW	Concrete	Head gt	43,886	Manual	BG	0.85	13.2	10C,	3CGE
440,000	6	1939-49	2,136,000	2	8,000	Francis	180	82-75	80	DEW	DEW	Concrete	Head gt	7,700	Manual	AG	0.90	13.2	60	CGE
				10	53,000	Francis	75	82-75	80	DEW	DEW	Concrete	Head gt	46,525	Manual	BG	0.90	13.2	60	CGE
503,000	6	1952-53	.....	6	53,000	Francis	75	82-75	80	CAC	W	Concrete	Head gt	51,000	Automatic	AG	0.80	13.8	60	CWC
				6	53,000	Francis	75	82-75	80	DEW	W	Concrete	Head gt	51,000	Automatic	AG	0.80	13.8	60	CGE
325,000	3	1951	390,000	5	65,000	Francis	128.6	160	160	DEW	W	Plate st	Head gt	53,000	Automatic	AG	0.90	13.8	60	CGE
2,650	..	.....	2,650	2	1,325	Propeller	180	22	22	DEW	W	Concrete	Head gt	1,125	Manual	AG	0.80	2.4	60	CGE
282,500	..	.....	282,500	5	56,500	Francis	105.9	115-95	110	CAC	W	Concrete	Head gt	53,500	Manual	BG	0.70	13.8	60	CWC
282,500	..	.....	282,500	5	56,500	Francis	105.9	115-95	110	DEW	W	Concrete	Head gt	53,500	Manual	AG	0.70	13.8	60	CGE
56,700	..	.....	337,700	1	56,700	Francis	112.5	128-116	124	MSC	W	Welded pl st	Head gt	37,500	Automatic	AG	0.95	13.8	60	CGE
26,000	..	.....	26,000	2	13,000	Francis	200	122-70	122	CAC	W	Plate st	Butterfly	11,000	Manual	AG	0.80	13.8	60	CGE
700,000	..	.....	1,200,000	7	100,000	Francis	150	305-294	292	DEW	W	Plate st	Head gt	80,500	Automatic	AG	0.95	13.8	60	{6CGE 1CWC
264,000	..	.....	264,000	4	33,000	Francis	94.7	82-72	77	CAC	W	Concrete	Head gt	27,000	Automatic	BC	0.95	13.8	60	CWC
				4	33,000	Francis	94.7	82-72	77	JIC	W	Concrete	Head gt	27,000	Automatic	BG	0.95	13.8	60	CWC
496,500	1	1951	496,500	8	62,000	Francis	105.9	135-124	130	DEW	W	Plate st	Head gt	50,000	Manual	AG	0.90	13.8	60	CWC
168,000	6	1951	168,000	8	21,000	Propeller	94.7	41-25	40	DEW	W	Concrete	Head gt	17,000	Manual	AG	0.90	13.8	60	CGE
	1	1945	.....	1	2,200	Francis	514	132-125	125	JL	W	Cast st	Steel case	1,800	Manual	HS	0.85	2.5	60	CWC
2,200			12,500	1	2,500	Francis	360	132-125	125	MSC	W	Plate st	Steel case	2,250	Manual	HS	0.85	2.5	60	CWC
	2	1950-51	.....	2	3,000	Francis	460	132-125	125	CVL	W	Plate st	Butterfly	2,810	Manual	AG	0.85	2.5	60	CWC
20,000	..	.....	20,000	2	10,000	Kaplan	225	78-61	70	MSC	W	Plate st	Head gt	8,500	Manual	AG	0.80	12.5	60	CGE
15,000	..	.....	15,000	2	7,500	Kaplan	200	51-47	48	MSC	W	Concrete	Head gt	5,000	Manual	AG	1.00	11.5	60	CGE
112,520	3	1949-51	225,000	3	37,500	Propeller	138.5	.....	.....	HS,IAC,IDEW	W	Concrete	Head gt	32,500	Manual	AG	0.85	11.00	60	CGE
				3	37,500	Propeller	128.6	66	66	DEW	W	Concrete	Head gt	32,500	Manual	AG	0.85	11.00	60	CGE
114,000	3	1952	114,000	6	19,000	Propeller	94.7	37	37	DEW	W	Concrete	Head gt	15,500	Auto. or man.	AG	0.90	13.8	60	CGE
7,000	..	.....	7,000	2	3,500	Francis	300	55	55	CAC	W	Concrete	Head gt	2,750	Manual	AG	0.80	2.4	60	CGE
4,700	..	.....	4,700	1	4,700	Propeller	277	62-30	50	DEW	W	Welded pl st	Butterfly	4,000	Automatic	BC	0.85	6.9	60	CWC
9,000	..	.....	21,000	1	12,000	Francis	225	72	72	DEW	W	Welded pl st	Head gt	11,500	Auto. or man.	AG	0.85	13.2	60	CWC
23,000	..	.....	23,000	1	23,000	Francis	300	318	318	DEW	W	Welded pl st	Head gt	20,000	Auto. or man.	AG	0.85	13.2	60	CWC
3,000	..	.....	3,000	1	3,000	Francis	450	120-110	118	DEW	W	Plate st	Head gt	3,000	Manual	AG	0.85	6.9	60	CGE
70,000	..	.....	70,000	1	70,000	Francis	240	410-380	400	PW & VEW	PW	Plate st	Head gt	62,500	Automatic	BG	0.80	13.8	60	CWC
82,000	..	.....	82,000	1	82,000	Impulse	360	2035	1880	PW & VEW	PW	Cast st	Spherical	75,000	Automatic	AG	0.80	13.8	60	CGE
56,000	4	1949-53	166,000	6	28,000	Francis	327.3	410-394	390	DEW	W	Plate st	Butterfly	25,000	Manual	AG	0.80	13.8	60	CWC
33,000	..	.....	66,000	2	16,500	Francis	600	715-667	690	CAC	W	Welded pl st	Butterfly	12,500	Manual	AG	0.90	6.9	60	CGE
4,000	..	.....	12,000	2	2,000	Francis	600	170-120	160	PW & VEW	W	Cast st	Butterfly	1,875	Manual	AG	0.80	4.16	60	BCL

PW – Pelton Water Wheel Co
VEW – Vancouver Engineering Works, Ltd
W – Woodward Governor Co
BCL – Bepco Canada, Ltd
CGE – Canadian General Electric Co, Ltd
CWC – Canadian Westinghouse Co, Ltd
EC – Elliott Co
EM – Electric Machinery Mfg Co
GE – General Electric Co
IE – Ideal Electric & Mfg Co
OC – Oerlikon, Canada, Ltd
SEC – Swedish Electric Co, Ltd
WE – Westinghouse Electric Corp

*AG – indicates that the thrust bearing is above the generator; BG, thrust bearing is below the generator; HS, horizontal-shaft machine.

Dam, tunnels, and steel pipe conduits are being designed and built by the New York Board of Water Supply as part of its Delaware River water system.

Two power plants are being built, one in Mexico and one in the United States, three 14,750-hp units in each.

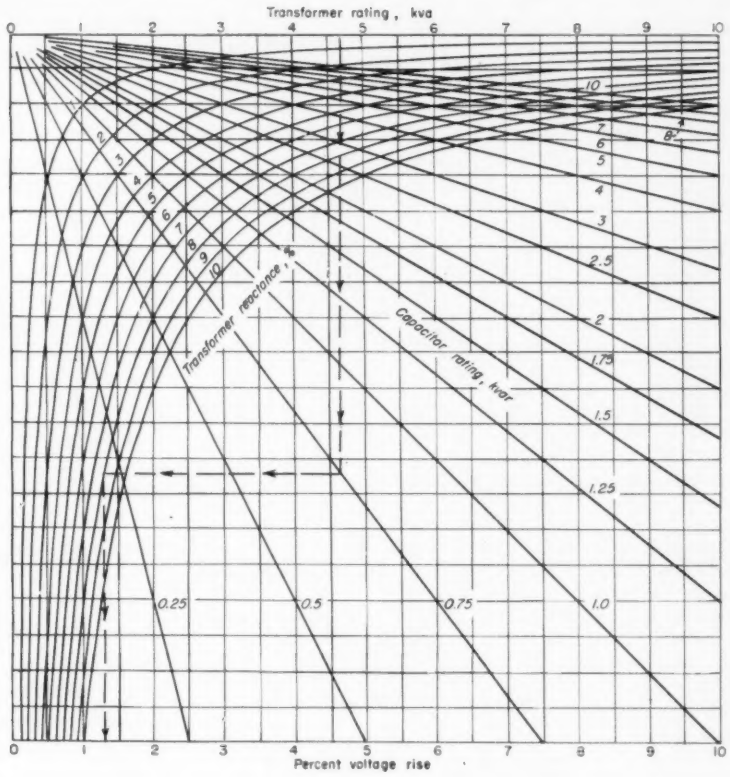
Government-Agency Hydroelectric Plants

(Does not include municipal plants)

Government agency	Project	State	River	Ultimate capacity, hp	Initial capacity, hp	Installed capacity, hp	On order or being installed, hp
U. S. Bureau of Reclamation	Eklutna	Alaska	Lake Eklutna	50,000	50,000	.....	50,000
	Grand Coulee	Wash.	Columbia	3,102,000	538,000	3,102,000	.....
	Hungry Horse	Mont.	So. Fork Flathead	420,000	420,000	.....	420,000
U. S. Corps of Engineers	Bonneville	Ore. & Wash.	Columbia	729,000	137,000	729,000	.....
	Big Cliff	Ore.	North Santiam	26,500	26,500	.....	26,500
	Detroit	Ore.	North Santiam	140,000	140,000	.....	140,000
	Chief Joseph	Wash.	Columbia	2,700,000	1,000,000	.....	1,900,000
	McNary Dam	Ore. & Wash.	Columbia	1,567,400	899,400	.....	890,400
	Albeni Falls	Idaho	Pend Oreille	58,000	58,000	.....	58,000
U. S. Bureau of Reclamation	Anderson Ranch	Idaho	Boise	55,500	37,000	37,000	.....
	American Falls	Idaho	Snake	42,000	42,000	.....	.....
	Minidoka	Idaho	Snake	28,500	9,000	19,500	.....
	Palisades	Idaho	Snake	157,200	117,900	.....	.....
	Shasta	Calif.	Sacramento	522,000	419,000	522,000	.....
	Keswick	Calif.	Sacramento	102,000	102,000	102,000	.....
	Folsom	Calif.	American	225,000	225,000	.....	225,000
Imperial Irrigation District	Drop No. 2	Calif.	All Am. Canal	15,000	15,000	.....	15,000
	Drop No. 3	Calif.	All Am. Canal	15,000	7,500	7,500	.....
	Drop No. 4	Calif.	All Am. Canal	28,300	13,300	28,300	.....
U. S. Bureau of Reclamation	Parker Dam	Ariz. & Calif.	Colorado	160,000	120,000	160,000	.....
	Davis Dam	Ariz. & Calif.	Colorado	311,000	311,000	311,000	.....
	Hoover Dam	Ariz. & Nev.	Colorado	1,857,000	522,000	1,442,000	300,000
	Elephant Butte	N. M.	Rio Grande	34,500	34,500	34,500	.....
	Green Mountain	Colo.	Blue	30,000	30,000	30,000	.....
	Estes Park	Colo.	Colo. Big Thompson	63,000	63,000	63,000	.....
	Mary's Lake	Colo.	Colo. Big Thompson	11,300	11,300	11,300	.....
	Pole Hill	Colo.	Colo. Big Thompson	47,500	47,500	.....	47,500
	Flatiron	Colo.	Colo. Big Thompson	96,000	96,000	.....	96,000
	Kortes	Wyo.	North Platte	55,500	55,500	55,000	.....
	Shoshone	Wyo.	Shoshone	20,000	20,000	20,000	.....
	Heart Mountain	Wyo.	Shoshone	8,300	8,300	8,300	.....
	Boysen	Wyo.	Big Horn	21,000	21,000	.....	21,000
	Alcova	Wyo.	North Platte	53,000	53,000	.....	53,000
	Seminoe	Wyo.	North Platte	45,000	45,000	.....	.....
	Canyon Ferry	Mont.	Missouri	70,500	70,500	.....	70,500
U. S. Corps of Engineers	Fort Peck	Mont.	Missouri	150,000	70,000	120,000	.....
Platte Valley Pub Pr & Irr Dist	Sutherland	Neb.	North Platte	35,000	35,000	35,000	.....
Consumer Public Power Dist	Spencer	Neb.	Niobrara	3,740	1,540	3,740	.....
Loup River Public Power Dist	Monroe	Neb.	Loup	9,600	9,600	9,600	.....
	Columbus	Neb.	Loup	54,000	54,000	54,000	.....
Central Neb. Pub Pr & Irr Dist	Jeffery Canyon	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 1	Neb.	Platte	26,000	26,000	26,000	.....
	Johnson No. 2	Neb.	Platte	50,000	25,000	25,000	.....
U. S. Bureau of Reclamation	Angostura	S. D.	Cheyenne	1,675	1,675	1,675	.....
U. S. Corps of Engineers	Fort Randall	S. D.	Missouri	460,000	230,000	.....	230,000
	Garrison	N. D.	Missouri	440,000	176,000	.....	176,000
	St. Mary's Falls	Mich.	St. Mary's	72,750	23,925	23,925	.....
	Norfolk	Ark.	North Fork	168,000	42,540	84,540	.....
	Blakely Mountain	Ark.	Ouachita	106,000	106,000	.....	106,000
	Bull Shoals	Ark.	White	211,000	159,000	.....	211,000
	Narrows	Ark.	Little Missouri	36,000	24,000	24,000	.....
Grand River Dam Authority	Pensacola Dam	Okla.	Grand	120,750	80,750	120,750	.....
U. S. Corps of Engineers	Fort Gibson	Okla.	Grand	96,000	64,000	.....	64,000
	Tenkill Ferry	Okla.	Illinois	47,000	47,000	.....	47,000
	Denison Dam	Okla. & Texas	Red	282,000	56,000	114,000	.....
Lower Colorado River Authority	Buchanan Dam	Texas	Colorado	51,900	34,600	51,900	.....
	Tom Miller	Texas	Colorado	20,000	20,000	20,000	.....
	Inks Dam	Texas	Colorado	16,000	16,000	16,000	.....
	Marshall Ford	Texas	Colorado	90,000	90,000	90,000	.....
	Granite Shoals	Texas	Colorado	66,000	66,000	.....	66,000
	Marble Falls	Texas	Colorado	42,000	42,000	.....	42,000
Brazos Riv Conserv & Reclam Dist	Possum Kingdom	Texas	Brazos	51,000	34,000	34,000	.....
International Boundary & Water Comm.	Falcon Dam	Texas & Mex.	Rio Grande	88,500	88,500	.....	88,500
U. S. Corps of Engineers	Whitney Dam	Texas	Brazos	41,400	41,400	.....	41,400
	Wolf Creek	Ky.	Cumberland	377,000	377,000	.....	377,000
Tennessee Valley Authority	Kentucky	Ky.	Tennessee	220,000	176,000	220,000	.....
	Pickwick	Tenn.	Tennessee	302,000	96,000	247,000	55,000
	Wilson	Ala.	Tennessee	610,000	286,000	610,000	.....
	Wheeler	Ala.	Tennessee	360,000	90,000	360,000	.....
	Guntersville	Ala.	Tennessee	141,000	102,000	141,000	.....
	Hales Bar	Tenn.	Tennessee	140,000	72,000	72,000	68,000
	Chickamauga	Tenn.	Tennessee	144,000	108,000	144,000	.....
	Watts Bar	Tenn.	Tennessee	210,000	126,000	210,000	.....
	Norris	Tenn.	Clinch	132,000	132,000	132,000	.....
	Fort Loudoun	Tenn.	Tennessee	176,000	88,000	176,000	.....
	Cherokee	Tenn.	Holston	166,000	83,000	83,000	41,500
	Douglas	Tenn.	French Broad	166,000	83,000	124,500	.....
	South Holston	Tenn.	Holston	49,500	49,500	49,500	.....
	Boone	Tenn.	So. Fork Holston	103,500	103,500	.....	103,500
	Watauga	Tenn.	Watauga	69,000	69,000	69,000	.....
	Fontana	N.C.	Little Tennessee	274,000	183,000	183,000	91,500
	Apalachia	Tenn.	Hiwassee	106,000	106,000	106,000	.....
	Hiwassee	N.C.	Hiwassee	160,000	80,000	80,000	.....
	Chatuge	N.C.	Hiwassee	10,700	10,700	.....	.....
	Nottely	Ga.	Nottely	13,400	13,400	.....	.....
	Ocoee No. 3	Tenn.	Ocoee	33,500	33,500	33,500	.....
	Ocoee No. 2	Tenn.	Ocoee	25,000	25,000	25,000	.....
	Wilbur Dam	Tenn.	Watauga	9,700	9,700	9,700	.....
U. S. Corps of Engineers	Buggs Island	Va. & N. C.	Roanoke	325,000	172,000	.....	172,000
	Philpott	Va.	Smith	19,640	19,640	19,640	.....
	Central Hill	Tenn.	Carney Fork	188,750	188,750	188,750	.....
	Dale Hollow	Tenn.	Obey	75,000	50,000	50,000	25,000
	Old Hickory	Tenn.	Cumberland	180,000	180,000	.....	180,000
	Allatoona	Ga.	Etowah	152,900	102,900	102,900	.....
	Buford	Ga.	Chattahoochee	118,400	118,400	.....	118,400
	Jim Woodruff	Fla.	Chattahoochee	42,000	42,000	.....	42,000
	Clark Hill	Ga. & S. C.	Savannah	388,600	388,600	.....	388,600
S. Carolina Public Service Auth	Santee-Cooper	S. C.	Santee	215,720	173,060	175,720	.....
	Santee-Spillway	S. C.	Santee	2,720	2,720	2,720	.....
Greenwood County Board of Comm	Buzzards	S. C.	Saluda	30,000	22,200	22,200	.....
	Total Capacity			21,438,225	11,333,720	11,244,740	6,217,100

POWER DATA SHEET

NUMBER 237



Capacitor Voltage Rise

► To raise voltage level with a low power-factor load, connect a capacitor across the secondary terminals of the supply transformer. This chart figures the percent rise in voltage to be expected for given transformer and capacitor ratings and transformer reactance.

Example: Find the voltage improvement by connecting a 0.75-kvar capacitor across the terminals of a 4.65-kva transformer with an 8% reactance. Enter chart at top scale with 4.65 kva and follow trace to intersect 0.75-kvar curve, turn left to intersect 8% reactance and then down to find 1.3% voltage rise.

This chart may be used for any range of kva and kvar capacities. For instance, if you wish to find voltage rise for a 50-kva transformer and 5-kvar capacitor, simply divide both kva and kvar ratings by 10 and enter chart with these figures to find answer directly. For kva from 100 to 999, divide kva and kvar by 100, and so forth.

This chart assumes the primary-circuit reactance as negligible compared to transformer reactance. When short-circuit kva at transformer primary drops below *100 × transformer rating*, add the system reactance to transformer reactance for more accurate results.

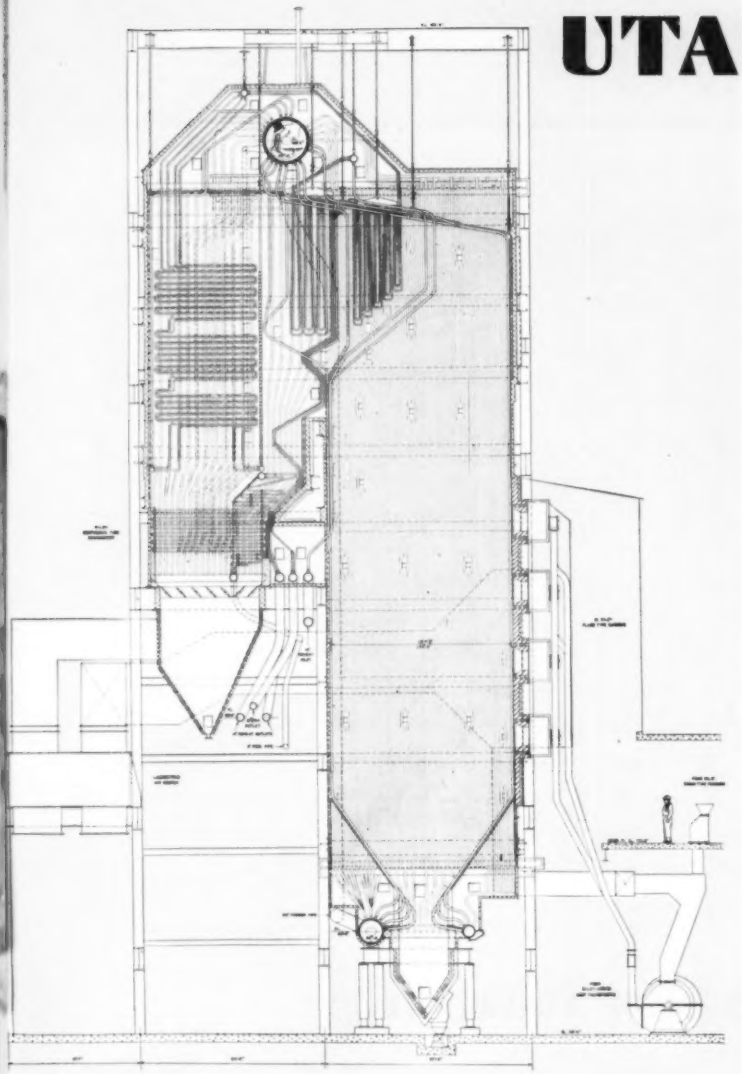
For rough approximations you can use the following reactances:

Single-phase transformers, up to 15-kv	
Kva rating	*Reactance, %*
20-50	2.5
75-200	4.0

Transformers above 300 kva	
Voltage, kv	*Reactance, %*
Up to 23	5.5
34.5	6.0
46	6.5
69	7.0

These values are for 60-cycle applications, error negligible for 50 cycles.

UTAH Goes to



Utah Power and Light Company is installing a 575,000 lbs. per hour 1700 psig 1000°F. Riley unit with 525,000 lbs. per hour reheat at 396 psig and 1000°F. at its Gadsby station at Salt Lake City as unit No. 2. Some of the outstanding features of this unit are mentioned on the following page. Unit No. 1 now in operation is a 620,000 lbs. per hour 1500 psig, 955°F. Riley unit. Unit No. 2 is to be fired with Riley "50" Pulverizers. Unit No. 1 is fired with petroleum pitch but designed for future pulverized coal firing.

At its Hale Station, Utah Power has installed a 450,000 lbs. per hour Riley pulverized coal fired unit and another Riley unit is installed at its subsidiary Western Colorado Power Co., Jim Bullock Plant at Montrose, Colorado.

Engineering Data

Capacity, 575,000 lbs. hr.
Design Pressure, 1,700 psig.
Steam Temperature, 1,000°F.
Reheat Temperature, 1,000°F.
Furnace Volume, 53,000 cu. ft.
Temp. Furnace Exit Gas, 1,900°F.
Furnace Width, 29'3"
Furnace Depth, 23'10⅞"
Efficiency, 87.8%
Fired by 4 Riley "50" Pulverizers and 12 Riley Flare Type Burners

Utah Power & Light Co., Salt Lake City, Utah
575,000 lbs./hr. — 1700 psig, 1000°F. — 525,000 lbs. hr. reheat — 396 psig, 1000°F.
Bechtel Corp., Engineers.

TRADE MARK Rx REGISTERED

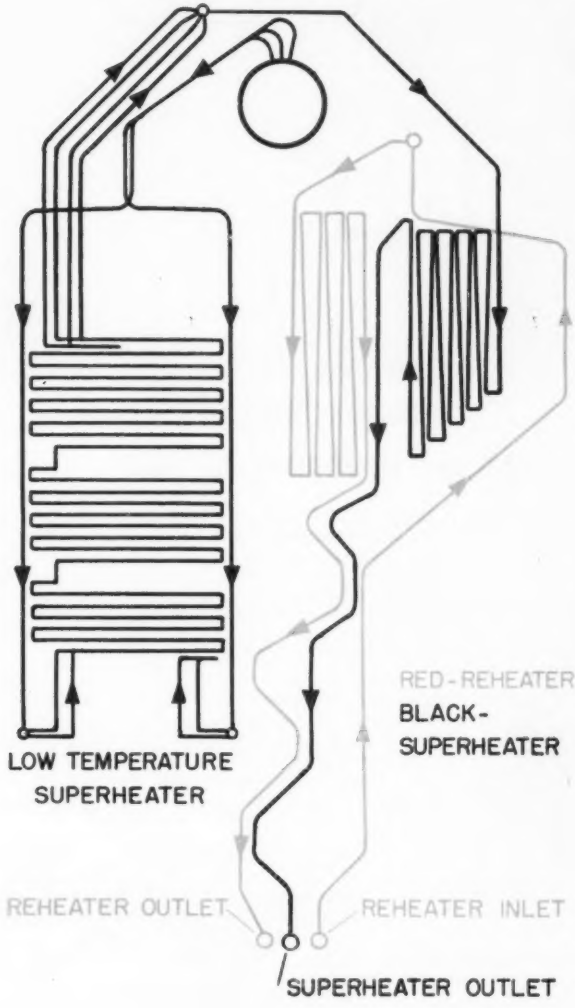
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

1700 psig 1000° F and 1000° F Reheat



Reheater Partially Radiant

Due to the large amounts of heat required to give 1000°F. steam temperatures for both superheater and reheater, design features must be incorporated which will give the desired steam temperatures and at the same time permit operation at sufficiently low furnace temperatures to prevent objectionable slagging of furnace and screen tubes.

Riley accomplishes this by making the first section of the reheater of radiant surface as illustrated in the accompanying diagram. With the relatively low reheater inlet temperature and high positive flow velocities the use of radiant surface is definitely warranted. By this design the desired steam temperatures are obtained with entering gas temperatures well below the danger point.

Uniform superheat temperatures over a wide load range are obtained by means of by-pass dampers beyond the economizer. A spray type temperature control is provided for the reheater. The use of four rows of burners also aids in controlling steam temperatures.

All tubes entering the upper and lower drums are welded to stub ends, shop welded into the drum shells. All superheater and economizer tubes are likewise welded to stubs ends welded to the headers. Such construction assures permanent tight connections.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

You'll find them only in the

JOY WG-9 COMPRESSOR

These Exclusive Features are worth Money to you!

Only the JOY WG-9, in its class, offers replaceable crosshead guides and cylinder liners, and full force-feed lubrication—features that will save you money in operating and maintenance costs. Unique truncated pistons and angled over-size "Dual-Cushion" valves assure higher valve capacity, better heat dissipation, lower air friction and elimination of valve pounding.

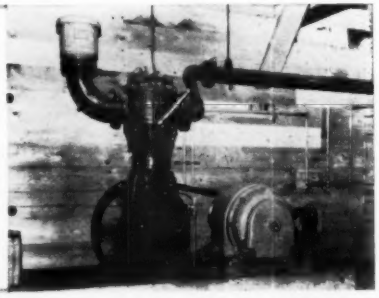
The WG-9 is a water cooled, double acting, single stage, heavy duty compressor for use where medium amounts of air are needed or for supplementary service in high air-requirement industries. Vertical design minimizes vibration and cuts required floor space. Foundation is but a simple concrete pad.

15 SIZES • 30 to 150 lbs. psi • 172 to 881 CFM

Consult a Joy Engineer

JOY COMPRESSORS Meet any Need

High and low pressure compressors, oil free compressors, boosters and vacuum pumps—Joy builds a type and size for every need. • Let us handle *your* air-supply job.



Over 100 Years of Engineering Leadership

WAD 1 4030

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING • PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

14,000 Engineers Soak Up Maintenance

At their annual plant maintenance conference last Jan 14 to 17, in Philadelphia, there were 14 sessions, 50 speakers, 276 exhibitors. Next year, the conference will be held about the same time in either Philadelphia or in Cleveland

Highlights of Technical Sessions...

FIVE BILLION dollars, at least, will go to maintain U.S. industry in 1952, according to a recent survey.

MR FIX-IT is no longer the right name for the maintenance boss. He's grown up to professional status. Now he is a maintenance engineer.

MAINTENANCE ENGINEER'S biggest job is to *plan it*, so you won't have to *fix it*. Keep maintenance records simple.

KEEP COMPARISON COSTS for same kinds of equipment. Then nail down reason for spending more money on one kind than on another.

HERE ARE 4 REASONS for most maintenance headaches: (1) wrong lubrication (2) not enough good water (3) too much heat (4) poor housekeeping.

IN ONE BIG PLANT 2267 of 9200 employes are in maintenance.

NO PROFIT produced by maintenance as such. It merely prevents loss.

70% of hydraulic maintenance is caused by hydraulic oil's condition.

MOTORS COST $80 to repair in one plant, but study showed new motors could be bought for only $50.

CUT DOWN MAINTENANCE INVENTORY by making a few pieces go a long way. That means standardization.

DON'T WASTE high-paid maintenance foreman's time by having him make out maintenance reports. Have clerk for this job.

RECORDS PAY DIVIDENDS. They help you get more money, help you figure upkeep costs, and point out good maintenance men.

IT'S CHEAPER to have small force of all-round maintenance men than to have large force of specialists.

ELECTRICAL MAINTENANCE MEN needed can't be based on total connected horsepower, or number of motors or machines. There are too many other things to consider.

DON'T BE GOAT for maintenance headaches in factory. Get written statement from foreman showing (1) when machine is idle (2) exact thing wrong with machine (3) who is to blame for breakdown and (4) when machine is needed. That's best way to get foreman's cooperation so he won't expect the impossible from maintenance department.

More on next page

MAINTENANCE COSTS

WE TRIED COMPARING our maintenance costs with outside figures. The experiment flopped because what's right for one plant is wrong for another.

Studies showed our skilled labor was only 65% effective—also, blame was more management's than labor's. Original work orders were often inaccurate, didn't give enough information. We're doing better now—ETHERIDGE.

YOU CAN'T RUN a 10-man maintenance dept like a 50-man. Small departments need more versatile workers—have to do most anything. Big department is forced to fit men into organization chart with head office and fancy controls.—DEMB

WE CALL OURS *cost comparison method.* It's easy because all our plants use same accounting system. Divide maintenance expense into productive dollars for any one period. Reduce ratio to a chart or curve for comparison between achievements, percentwise, for each plant.—HOUK

OF EVERY MAINTENANCE $ for buildings and grounds, 14¢ goes for grounds, including roadways, 7¢ for heating systems, 16¢ for outside walls, 16¢ for inside walls, 9¢ for roofs, 16¢ for floors, 10¢ for lighting, 6¢ for plumbing (including sprinklers), 6¢ for interior supports—FENELSON

SEPARATE MACHINERY and equipment maintenance expenses by types, such as motors, fans and blowers, piping, wiring, etc. Subdivide these into operating departments. Then if possible, into number pieces of equipment. Separate charges into labor, material and overhead.—KNIGHT

HERE ARE DATA to gather: (1) classes of machines needing lots of repairs compared to machines needing little (2) frequency of specific repairs, adjustments and checks (3) average labor and material costs for repetitive maintenance operations (4) points of frequent and serious failure you can study for improving design; best use of maintenance personnel and amount wasted on standby.—HOWARTH

HOW BIG a staff to handle maintenance? We handle about $500,000 in maintenance in one plant. That means about 250 projects in one year. We have 3 or 4 project engineers, 3 or 4 draftsmen, 1 construction supervisor, 1 cost-control clerk, 1 project-closing clerk, and 1 stenographer.—HAYDEN

TRAINING MAINTENANCE WORKERS

WITH 2267 MAINTENANCE MEN, we have training program for each shop. For instrument work, applicant must have high school, pass aptitude test with at least 75%. Before trainee is eligible as instrument senior helper, he serves 12 mo as helper. During last 6 mo he is given 60 hr of classroom work in electricity, math, and 18 hr of physics. Classroom work is on company time. But he must do more homework than classroom work to pass course. If worker passes test at end of one year, he becomes senior helper, enters 18-mo training period. That's broken down into 18 hr of blueprint reading, 351 hr of instrumentation. Field work is general, and trainee works with journeymen or technicians.—OREN

SMALL-PLANT MAINTENANCE

FIRST CLASS mechanics are needed: Also: (1) Do away with duplication. (2) Eliminate useless forms. (3) Have more than one department use multiple-purpose systems. (4) Use automatic tabulating machinery. (5) Cut non-operating man-hours to the bone in maintenance.

For small-job records (renewing gaskets in joints), don't use form that takes half an hour to fill out when repair job takes only 15 minutes.

Incentives for maintenance men won't work. Reason is time limit on some jobs may be way off. If maintenance man does job in half time, he feels good. But if it takes several hours longer, he'll yell. Then again, it takes a long time to set up job-time estimates. Besides, small plants don't have enough men to assign one to tough estimating job. Work out ways to inspect machines without tearing them apart. Small units often run longer periods without a teardown.—DEMB

ALL-ROUND mechanics save money. The more versatile the maintenance men are, the fewer you will need.—COX

PANEL

First general session is led off by: (l to r) O R Etheridge, A E Staley Mfg Co; C E Knight, Monsanto Chem Co; M H Howarth, Western Elec Co; L S Houk, Westinghouse Elec Corp; Chairman L C Morrow, consulting editor, *Factory* magazine

HEADMEN

Manly Fleischmann, administrator, Defense Production Adm, Nat Production Authority, Washington, D.C., addresses banquet on last night of conference at Warwick Hotel. L C Morrow, mentioned above, shares spotlight as toastmaster

ELECTRICAL MAINTENANCE

HERE'S QUICK CHECK LIST for foremen: (1) Make tours through plant, note unsafe practices, improper maintenance or installations. (2) Keep close to electricians, and follow up on all jobs. (3) Keep lookout for new developments in field. (4) Know power-distribution system thoroughly. That means setup from incoming service throughout plant, to each sub-station or low distribution point. (5) Spare parts can be nightmare. Have smooth-working stock dept to tie spare parts into each machine. Do this by placing spare coils, relay parts, etc, right in electrical cabinets at each machine. You can then put your hand on parts needed in emergency.

Check instrument, such as voltmeter, after each use. Otherwise, electrician uses damaged one without knowing it.

Lights are replaced during 12th to 13th month, except cold cathodes, which are replaced about every 2½ to 3 yr.

High-voltage switch gear and connected relays in the 2.3- or 4.2-kv class are checked for accuracy twice a year. Check oil in switchgear once a year.—PETRUSKA

LUBRICATION SAVVY

TIME TO CONSIDER lube problems is when designing new equipment. Because of faster machines, higher loadings and closer tolerances, here are factors: (1) higher temperature lubricants (2) better chemical stability in lube oil (3) better mechanical stability (4) more uniform lubricants (5) oils compounded for special properties (6) improved surface finish and metallurgy (7) improved devices for application. Cost of installing centralized lubrication in a new machine is often saved in a short time.—BAILEY

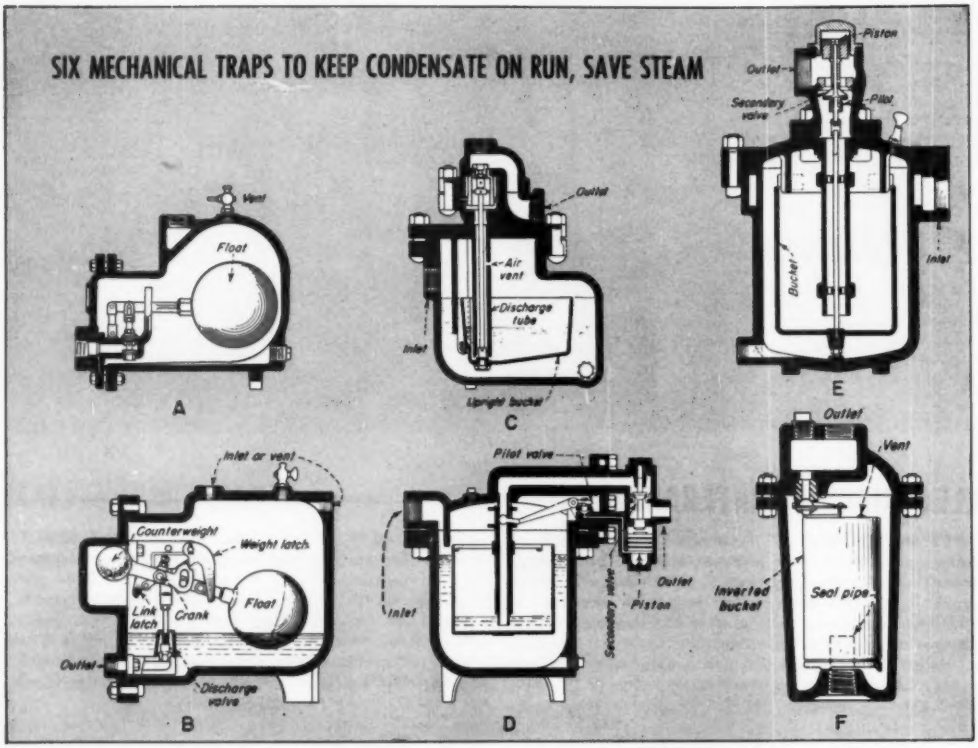
BEST WAY to get solid film on bearing surfaces is to form it by chemical reaction between metal and fluid under extreme temperature and pressure between parts. This is done by adding chemical additives to oil. For example, sulfur compounds are good additives for high-pressure lubricants. If bearing surfaces in this case are steel, then solid film formed by chemical reaction at high spots is mostly iron sulfide. This film helps prevent metal-to-metal bonding in seizure. Other chemical additives give similar results.—MERCHANT

HOW ABOUT INVENTORY?

HOW TO PROTECT yourself against getting caught short and yet not tie up a lot of money on the shelves these days of high prices and long deliveries? Answer is to make a few pieces go a long way. That means standardization. Our mechanical storeroom runs on an inventory of about 3% of the installed value of equipment in plant, with a turnover of 2.2%.—WOOLFENDEN

WHO'S WHO

C A BAILEY, U.S. Steel Co, Pittsburgh, Pa.
N P COX, Armstrong Cork Co, Lancaster, Pa.
K DEMB, Sylvania Elec Prod, Inc, Danvers, Mass.
O R ETHERIDGE, A E Staley Mfg Co, Decatur, Ill.
E S FENELSON, H J Heinz Co, Pittsburgh, Pa.
H L HAYDEN, E I DuPont de Nemours & Co, Inc, Arlington, N. J.
L S HOUK, Westinghouse Electric Corp, Pittsburgh, Pa.
M H HOWARTH, Kearney Works, Western Electric Co, Kearney, N. J.
C E KNIGHT, Monsanto Chemical Co, Springfield, Mass.
M E MERCHANT, Cincinnati Milling Mach Co, Cincinnati
C O OREN, The Dow Chemical Co, Midland, Mich.
J PETRUSKA, Wright Aeronautical Co, Wood Ridge, N. J.
L B WOOLFENDEN, General Aniline & Film Company, Crasselli, New Jersey



1 Simple ball-float trap *A* has a petcock vent. *B*: snap-action float trap. Upright bucket *C* sinks to open the discharge valve. Pilot valve used in traps *D* and *E*. Pilot valve relieves load on the bucket. *F*: inverted-bucket trap

Don't Waste Steam: Fit Trap to Job

By **TYLER HICKS**
Associate Editor

To handle condensate you must know steam traps. Here's the dope on a few mechanical types used today. Learn how they can save steam, keep power and process units air-free

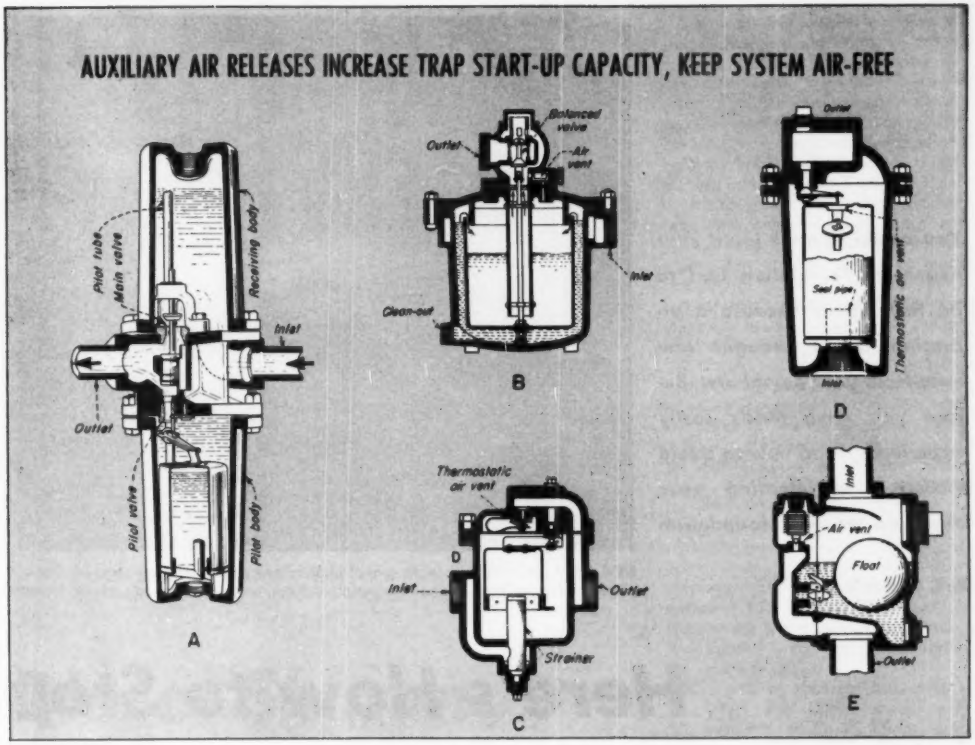
► LOOKING OVER TRAPS today you'll find there are three main types: mechanical, thermostatic and thermodynamic (labyrinth or orifice units). Let's see how some mechanical traps work.

Ball-Float Traps. This type, Fig. 1A and 1B, has a floating ball that rises and falls with condensate level. When trap is full, or nearly so, ball is at top of its travel and opens the discharge valve. Steam pressure in tank or unit being drained pushes condensate through discharge valve into return line. Ball falls as condensate leaves, closes discharge valve so steam can't pass. Petcock allows air to be released by hand during start-up.

Since steam pushes condensate out, there is direct contact between the two, and condensate leaving has same temperature as steam. Trap in Fig. 1B has a linkage that snaps discharge valve open and closed. Ball-float traps find many uses in modern plants, can give continuous discharge without shock.

Bucket Traps. Open-bucket traps, Fig. 1C, 1D and 1E, run intermittently, discharge condensate at steam temperature. With trap, Fig. 1C, in normal filling position, bucket is empty and floats on condensate in trap body. Discharge valve is closed. Condensate rises until it overflows into bucket, causing it to sink and open discharge valve. Steam pressure on condensate surface forces it out of bucket and up discharge tube to outlet. When bucket is empty, it floats again and closes discharge valve. Action is smooth.

Air that enters trap in Fig. 1C col-



2 Compound inverted-bucket trap *A* uses secondary valve, has large capacity. *B:* bleed vent in trap top passes air to the discharge. *C* has thermostatic bypass. Thermostatic vent *D* lets the bucket sink. *E:* air vent on a float trap

lects above condensate and is vented through a hole in discharge tube. Vent hole is above water line.

Traps in Fig. 1D and 1E have a piston-operated secondary valve for main discharge. Bucket opens small pilot valve to admit steam to operating piston. Discharge valve has a smaller area than piston so it opens this valve easily.

Inverted Bucket. In this type, Fig. 1F, open end of bucket is at bottom of trap body. Discharge-valve operating mechanism is attached to upper or closed end of bucket. Steam and air enter open end of bucket because it's directly above trap inlet.

With trap empty, bucket rests on bottom and discharge valve is open. When steam is turned on, water fills trap body. Excess water escapes through discharge until steam reaches trap and fills bucket, which floats and closes the discharge. Steam in bucket condenses, water enters, bucket loses its bouyancy and sinks to open discharge valve. While this valve is open, steam pressure forces air and condensate out of trap until bucket floats again. Inverted-bucket trap runs intermittently, discharges condensate at steam temperature and purges a small amount of air each time trap works.

Compound Traps. Now let's take a look at a compound inverted-bucket trap that handles very large volumes of condensate. Units like this are used at low, medium and high pressures.

Entering condensate flows to the receiving body, Fig. 2A, from which it forces air down the pilot tube and under the bucket in the pilot body. From here the air passes through bucket vent and the pockets around pilot valve. When receiving body is full, water flows down pilot tube and under trap bucket. Bucket loses its buoyancy, sinks, and opens pilot valve to apply pressure to main valve piston. Movement of piston uncovers a relief port, which bleeds off excess pressure (air and water) to limit piston travel. When steam enters, it flows down pilot tube, and again floats bucket before lower chamber empties.

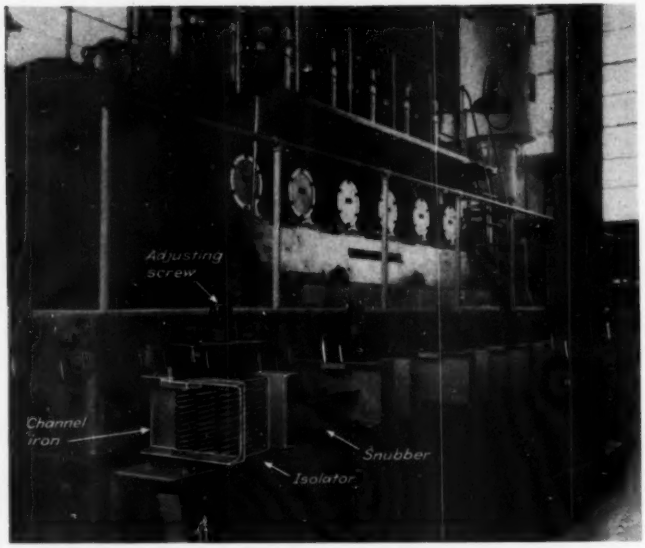
Air Releases. Since relief of air from a system is important, you'll often find inverted and upright bucket traps fitted with special air releases. These do a good job of stepping up trap's air-handling capacity.

Bleed vent in trap top, Fig. 2B, passes air to discharge valve ahead of condensate. Inverted-bucket trap, Fig. 2C, has a thermostatic bypass that works independently of the main discharge valve. Thermostatic vent of trap, Fig. 2D, which is in top of bucket, causes it to sink quickly when air enters.

Float traps usually need a thermostatic bypass because if enough air enters to force condensate out, float falls and closes the valve. Vent on trap in Fig. 2E works automatically, keeps trap air-free. When fitted with a thermostatic bypass, traps have a larger start-up capacity. Air in unit trapped is relieved before steam reaches the trap. When steam, at higher temperature than air, reaches vent it closes.

You would squawk too if your expensive foundation had to be torn down because a vibrating diesel brought law suits from your neighbors. Before you have Mac's costly experience, read how to avoid vibration by floating your diesel on the right foundation

By C MORGAN JONES



NEW FOUNDATION, with eight sets of channels extending through concrete block, is vibration free. These spring-type isolators float engine, taking all of its vibration

Here's How to Stop

► MAC BARGED INTO my place waving an official-looking bunch of papers. His face was beet red. "Look at this—they're trying to put me out of business, the so-and-so's. All because my new diesel plant shakes their windows a bit."

I learned that after excavating and pouring a sound concrete foundation, erecting this new generating set and running it in, Mac had junked his old corliss steam job and put the new diesel on the line.

Soon after the diesel took over, Mac was flooded with squawks. Tenants from apartments and business buildings complained the new engine was making life unbearable. It shook windows and spoiled television programs. A baker said his oven foundations were being destroyed by the diesel engine.

Mac roared and threatened to throw them out. Next he was faced with a court action.

I checked his plant. He had done a thorough job of erecting the diesel all right. It was good and solid. He had followed the oldest foundation rules, now obsolete for most purposes. That is, to make the concrete foundation the same weight as machine it supports. But he hadn't excavated deep enough. "Can't dig any deeper," he explained. "Four feet is limit because there are sewers and pipes under the building."

I explained to Mac that only way to overcome his trouble was to build a suspended foundation under his engine. Since he couldn't excavate for the foundation, it would have to be built above the floor. He said OK.

Foundation. From engine builder I learned that weight of concrete needed to support engine and generator was about 300,000 lb. Allowing 150 lb of concrete to the cubic ft, this gave a foundation volume of 2000 cu ft. Because height of the building basement controlled the foundation's height, we had to limit it to 4 ft, 6 in. This gave us a concrete area of 444 sq ft. So we made a foundation 28.5 ft long and 15.5 ft wide.

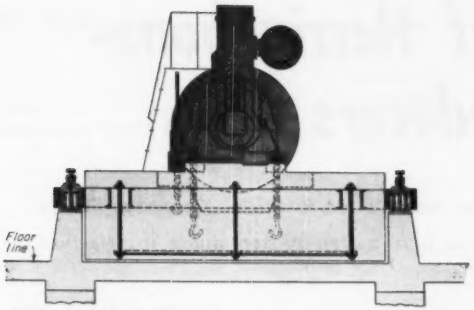
As foundation was to be suspended from vibration isolators, we first built a structural steel chassis of angle irons and tie rods. This chassis was for imbedding in the concrete. The tierods (shown in black) supported channel irons near the concrete block's bottom, which in turn reinforced the concrete.

Mac's template, sketch, made of 1x8-in. pine board, was strong and well stayed. Foundation bolts' positions had been carefully marked off, as well as engine's center line. Engine maker furnished template measurements. Holes in template were drilled snug for foundation's bolts. I used 12-in. channels in pairs, back-to-back and spaced 12 in.

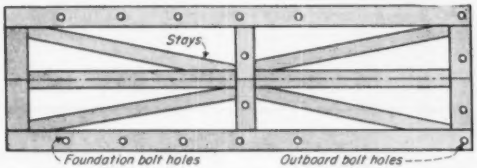
The steel-spring isolators were nested between channels, photo. Eight pairs of these channels ran through the foundation and extended 1½ ft beyond for the isolators. Snubbers, photo, between channels control movement of spring-suspended foundation.

Foundation form was built over Mac's original diesel foundation. Two layers of waterproof roofing paper were placed on floor to prevent foundation bonding to floor. Concrete was poured on top of this, into form built for block. We built the chassis inside the form.

Piers. We cut a channel in old foundation (floor line) with compressed-air drills, on each side of form and 6 in. from it. Dug to a depth of 12 in. and width of 22 in., this served as foundation for piers or walls to support foundation block and engine set.



CROSS SECTION of foundation shows how to embed channels and anchor bolts in concrete blocks. Isolators rest on the piers



FOUNDATION TEMPLATE is made of 1x8-in. boards and is well stayed. The holes are laid off from the center line as shown

Diesel Shimmy

Using the side timbers of foundation frame for one side of the pier form, we built outside 32 in. high. Base of pier was 20 in. wide, sloping inward to 14 in. top width.

Finally, one-inch reinforcing tierod was suspended from template we had strengthened with three 6x6-in. timbers to support it on top of form. That took weight of foundation bolts, plates and reinforcing rod placed in the wall forms.

With template lifted on top of form, I suspended foundation bolts from it by placing bolt heads through holes provided. Foundation bolts were threaded at top with hook at bottom end, sketch. All bolts, after template had been lined up with center mark on the form top, were checked to make sure they hung vertically inside their 2-in. pipe.

Pouring. Next we poured a mixture of one part portland cement, two parts clean sand, and four parts trap rock (2½-in. screen). Guiding it into every nook and cranny, we did very little tamping—just a touch here and there to avoid pockets, poured to the 4½-ft mark chalked on forms inside.

Then we poured piers but not before we had placed in position the isolators and snubbers on the girders' ends with their small foundation bolts dangling from them. We made sure these bolts were vertical and well covered with concrete. They can also be carried on individual templates, if that's handier.

Seven days later forms were torn down. I've seen them taken down after three days, but concrete curing depends on climatic conditions and proportion of sand and cement.

With forms and template removed, we tightened the vibration isolators and snubbers to their bases. Then with one man to two isolators, we gradually lifted the concrete block, using the isolator-adjusting bolts. Each man made same number of quarter turns on his bolt as Mac called the "time."

We picked up foundation further until it was one inch off floor. Then cleaned bits of wood, etc, from surface.

Sub-base. Next step was to mount engine sub-base. Well slung, the sub-base was hoisted over the top of foundation and lowered over its bolts. Because template was right, the bolts lined up perfectly with the sub-base.

Before resting base on concrete, we slipped half a dozen thin-steel wedges under it on each side. Then machinist's spirit levels were placed lengthwise on milled surface provided by manufacturer. Driving in and pulling out wedges, we eventually had sub-base perfectly level. End sections were also checked and accurately lined up. Finally, a stiff grout, half cement and half sand, was troweled under base and around wedges. (To hold it, we built a temporary shallow form 6 in. inside from top of block's perimeter). When this set hard, wedges were withdrawn (they can be left in) and their cavities filled with cement.

I erected the engine on its lined-up base. The old starting-air, fuel, cooling-water, air-intake, and exhaust lines were remade with flexible sections.

With all hookups made, we picked the engine up again with the isolator bolts and checked it once more for levelness with the block clearing the floor by 1 in. all around. Suspended from the walls, we took one final test before giving it the air. This was a crankshaft deflection test. The diesel passed it with honors. We turned the engine over a few times, then made a final check of clearances and adjusted the snubbers.

With engine running, movement of foundation was almost unnoticeable. We examined the foundation for signs of vibration. Even the flooring was free of faintest "shimmy." Mac had his vibrationless installation.

There's a type of isolator or damper to suit every diesel need on the market, also a large variety of insulation materials. Recommendations for your engine are available, without obligation, from reputable isolation manufacturers, and it's best to get their advice before starting your foundation. Don't get caught and have to do the job twice as Mac did. Do it right the first time.

DID YOU KNOW . . .

. . . that a cost study of diesel-driven ships compared to steam-turbine reduction gear drive, by Mississippi River firm, shows a yearly saving of $25,605? Ships are 4000 hp, and costs include fuel and lube oil, wages and maintenance. Interesting aspect is that diesel fuel costs $3.40 a barrel, and turbine fuel $2.51. Diesel averaged $8.90 for lube oil per day against 85 cents for turbine's lube oil.

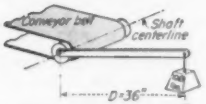
Figuring Size of Herringbone-Gear Speed Reducers

By W L BYLER, *DeLaval Steam Turbine Co*

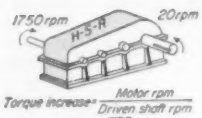
Here's the follow-up on last month's H-S-R article. Common pitfalls in figuring size are outlined, plus a step-by-step guide in selection

► THERE'S HARDLY a speed-reduction job that a herringbone-speed-reducer (H-S-R) can't handle. But you'll never get the life, reliability, freedom from maintenance the manufacturer built into it unless you start with the right size unit. Probably the biggest stumbling block in sizing is this matter of hp and torque. The problem comes to the front particularly at low speeds. At such speeds, hp ratings can be misleading. Just don't apply them—hp ratings—to speed reducers where input speed is 100 rpm or less. Let actual torque needs be your guiding light. And here's why.

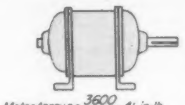
HORSEPOWER AND TORQUE



TORQUE . . .
. . . or twist needed can be found with a simple rig



MULTIPLICATION . . .
. . . of torque depends on ratio of the speeds used



POWER . . .
. . . of motor depends on H-S-R input torque needs

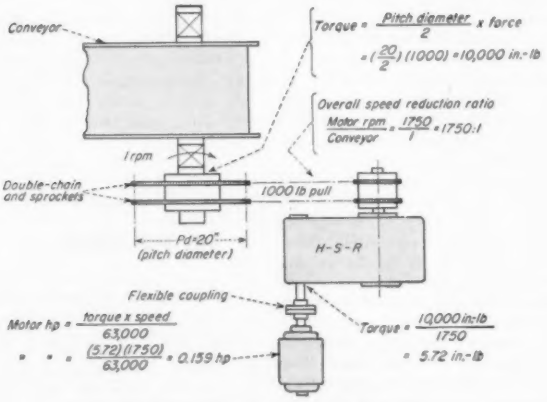
Torque is the twist effect caused by a force applied at some distance from the axis of rotation. And the machine doesn't have to turn to get torque. Horsepower includes both speed and torque (see formula to left). Here you can see that for a given hp, if speed drops torque goes up.

Take a six-to-one variable-speed transmission. It can develop six times motor torque at reducer end. When you overmotor slow-speed jobs, it means you must increase reducer size to handle possible torque that can be developed. Let's drive this home with an example.

Conveyor Drive. In conveyor-drive layout shown to left a 1/6th-hp motor is ample. But what often happens is someone remembers that 1-hp motor in the storeroom. It's installed and everything goes well until . . .

One day the conveyor is overloaded. Remember, this conveyor can handle up to 10,000 in.-lb torque on head shaft. But the motor doesn't know this. So it keeps on pulling. How hard can it pull before giving up the ghost? You can overload the reducer to 13 times its rated capacity (But you'll be sorry!) for the simple reason that the drive was overmotored in the first place.

HOW TO FIGURE THE MOTOR SIZE


Conveyor
Torque = Pitch diameter/2 x force
= (20/2) (1000) = 10,000 in.-lb
Overall speed reduction ratio
Motor rpm / Conveyor = 1750/1 = 1750:1
1 rpm
Double-chain and sprockets
1000 lb pull
Pd=20" (pitch diameter)
H-S-R
Flexible coupling
Motor hp = torque x speed / 63,000
= (5.72) (1750) / 63,000 = 0.159 hp
Torque = 10,000 in-lb / 1750
= 5.72 in.-lb

DON'T OVERMOTOR. STICK TO THE SIZE . . .

. . . determined as above. Trouble in overmotoring comes when machine is overloaded or jammed. Then all torque the motor can develop, plus that resulting from torque multiplication by speed reducer, comes to play. You may damage gears or shafting

WHAT IS A HORSEPOWER?

The combinations below represent 1 hp:

Speed, rpm	Torque, in.-lb
0.1	630,250
1.0	63,025
20.0	3,151
100.0	630
720	87.5
1150	53
1750	36

OVERHUNG LOADS

It is usually best to use flexible couplings on both shafts of a speed reducer. When sprockets, pinions, sheaves or pulleys are used, an overhung load is thrown on the shaft. Resultant increased unbalanced loading from the cantilever action of overhung load can cause speedy failure of reduction unit.

Here's how to figure overhung load.

1. Find shaft torque requirement. This varies for high- and slow-speed shafts because of speed difference.

2. Find overhung load from the following formula:

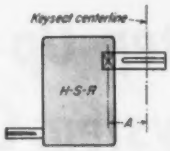
$$L = (T \times F) \div R$$

Where:

- L is overhung load in pounds.
- T is torque in in.-lb.
- R is pitch radius of sprocket, pinion, etc, in inches.
- F factor for sprockets, pinions, etc.

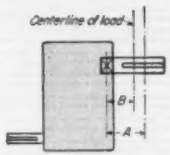
Typical F factors:

Single-chain sprocket	1.00
Double-chain sprocket or spur pinion	1.25
V-belt sheave	1.50
Flat-belt pulley	2.00



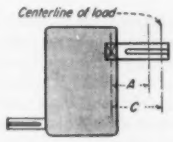
NORMAL

It's safe bet that manufacturer figured overhung load capacity based on the load at the keyseat center line; *A*: moment arm



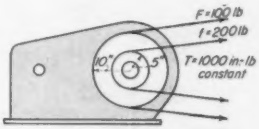
CLOSE PULLEY

Place load (pulley, sheave, pinion or sprocket) close as possible to reducer. Moment arm *B* is less; can increase load



FAR PULLEY

Moving load line further away from the reducer—toward end of shaft—increases distance from A to C; decrease the load



PULLEY SIZE

Increasing pitch-diameter of sprockets, sheaves, etc, decreases overhung load. Force halved when pulley size doubles

GUIDE FOR H-S-R SELECTION

Now let's tackle the actual job of figuring H-S-R size. A 40-hp 1750-rpm motor connects to an H-S-R input shaft through a flexible coupling. An unevenly loaded belt conveyor is the load. It will work 16 to 20 hr continuously each day. Calculated motor hp needed is 33 for normal running and 75 hp for starting. Reducer low-speed shaft will be fitted with a 10-in. pitch diameter double-chain sprocket running at 75 rpm. Here are the steps in selection:

Service Factor. From tables in manufacturer's catalog you find that a non-uniformly fed belt conveyor, operating between 10- and 24-hr per day and driven by an electric motor, is classed as a moderate shock load. Service factor is 1.50.

Then calculate equivalent hp rating. Do this by multiplying actual load by service factor: $33 \times 1.50 = 49.5$ hp. Next step is to find speed-reduction ratio. Simply divide rpm of driving shaft by rpm of driven shaft: $1750 \div 75 = 23.3$ to 1.

You can then determine reducer size. Refer to manufacturer's tables. In this case a double-reduction unit is needed with a ratio of about 23.3 to 1 and 49.5-hp catalog mechanical rating. You can find a unit having a ratio of 24.3 to 1 and 50-hp catalog mechanical rating. Overload capacity for starting or momentary peaks is 50×2 or 100 hp.

CHECK LIST FOR FIGURING SIZE

1. Load in hp or torque
2. Size and frequency of peak loads
3. Hours per day of service; continuous or intermittent
4. Type prime mover and driven machine
5. Speed of input, output shafts
6. Method of connecting shafting. Consider overhung load angle

This is greater than the 75 hp needed. Unit is acceptable.

Since ratio chosen is not the same as that calculated, you must find what output speed will be at the low-speed shaft. Divide motor speed by actual ratio to get driven speed: $1750 \div 24.3 = 72$ rpm. Then check thermal horsepower (see p 122, Feb 1952 POWER). Actual thermal horsepower needed is 33 hp. This reducer is rated 45 thermal hp so it's acceptable in this respect.

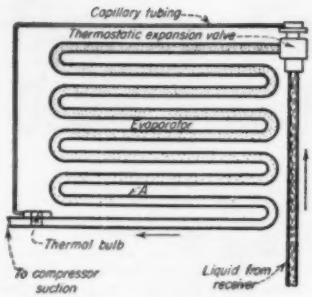
Then check overhung load. Say, a flexible coupling connects motor to high-speed shaft. So no check needed on input. On slow-speed shaft, torque is: $T = (63{,}000 \times \text{hp}) \div \text{N}$ or $(63{,}000 \times 33) \div 72 = 28{,}900$ in.-lb. Remember, *actual* hp transmitted is used. Overhung load is $L = (T \times F) \div R = (28{,}900 \times 1.25) \div 5 = 7240$ lb.

Overhung load capacity, of a standard single-row bearing, low-speed shaft mounting, is 5500 lb. This is not enough. Heavy-duty H-S-R's with double-row bearings on low-speed shaft are available at small extra cost. Double-row bearings on low-speed shaft will handle an overhung load of 8800 lb. This is greater than the 7240 lb chain pull. A heavy-duty unit must be used.

Where pinion is mounted directly on low-speed shaft, overhung load often exceeds heavy-duty ratings. In such cases, reducer manufacturer can furnish a base for motor and reducer, complete with an outboard bearing.

While the outboard bearing practice has been used for many years, there is now a trend to avoid it. Reason is reducer shaft is then similar to a continuous beam resting on three supports. This means one of the supports may take more than its share of load as low-speed shaft tends to deflect slightly under loading. Many engineers say the best way to handle such a job is to mount pinion on a separate shaft supported on each side by its own bearings.

One end of outboard pinion shaft should extend beyond its bearing to take a flexible coupling. With the flexible coupling connection the H-S-R is then doing its normal job of transmitting pure torque. Considerable money can be saved in the initial cost of reducer and a better drive results.



1 With a thermostatic expansion valve gas leaving evaporator is superheated

Step Up Refrigerating-System Capacity: Use Right Expansion Valve

► IF SOMEONE ASKED what you consider the most important valve in your refrigeration system you'd probably say the expansion valve. It's one valve you can't do without. If it works right everything is OK; when it goes on the blink you hear about it fast.

What Valve Does. Main job is to control refrigerant flow to evaporator. If too little liquid refrigerant enters your evaporator, it quickly flashes to a gas without absorbing much heat. When too much liquid enters coil, not all of it is vaporized and some floods back to compressor suction.

Either way you run into trouble. With not enough liquid, cooling capacity of system falls off. Too much liquid can wreck compressor valves and pistons because cylinder clearance is very small and liquid refrigerant is almost incompressible.

Thermostatic Valves. Today many expansion valves are the thermostatic type. Superheat of gas leaving evaporator, Fig. 1, changes the pressure of liquid in the thermal bulb. Pressure rise or fall is carried through capillary tube to a diaphragm in the expansion valve, opening or closing the valve.

Fig. 2 shows a typical ammonia thermostatic expansion valve, its thermal bulb and capillary tube. Pressure from thermal bulb opens valve against spring. Evaporator pressure and spring force tend to close valve. With a steady load on evaporator the three forces are balanced and valve stays open in one position. When load goes up, thermal bulb pressure rises from higher suction-gas temperature and valve opens wider to admit more liquid. Opposite happens when load goes down. Liquid in thermal bulb is usually the same as the refrigerant in system.

Gas Superheat. To remove most heat with a pound of your refrigerant it should enter evaporator as a liquid, leave as a gas. With this setup, gas leaving coil will be slightly superheated. Thermal bulb is connected at end of coil, Fig. 1.

Suction-gas superheat depends on amount of refrigerant fed coil and how fast it is evaporated by heat from load. If your valve is set for 10-F superheat, then gas leaving evaporator will be 10 F warmer than the evaporating liquid. So at some point in coil, say *A*, saturated gas starts to absorb heat to become superheated.

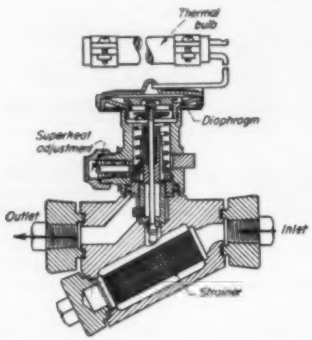
Between point *A* and the thermal bulb, evaporator coil is used only for superheating. When load falls there isn't enough heat absorbed between *A* and bulb to give 10 F desired. Bulb cools, closing valve to cut liquid flow to coil. Point *A* moves nearer liquid line so there's more coil length for superheating.

When load goes up, superheat temperature rises. Thermal bulb gets warmer, opens expansion valve wider to admit more liquid. Point *A* moves nearer bulb. So you can easily see that as load changes, point *A* moves to give right coil length for superheat needed.

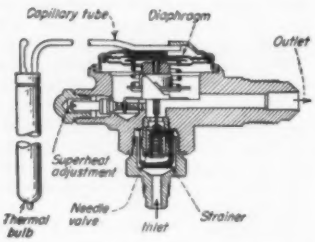
What Superheat? Your refrigerant picks up far more heat when it is vaporized from liquid to gas than when just dry gas is superheated. So the section of coil used to superheat the gas does little cooling. For this reason it is wise to keep superheat low. Then you can use more of the coil length for useful cooling.

But too low a superheat may cause liquid to flood suction line. Too high a superheat cuts capacity. You'll find many valves with a superheat adjustment range of 5 to 25 F. With a load that changes quickly a superheat of 10 F is often used. Manufacturer will set superheat before shipping valve if you ask him to do so. Some valves also have a suction-pressure limit adjustment to prevent system overload.

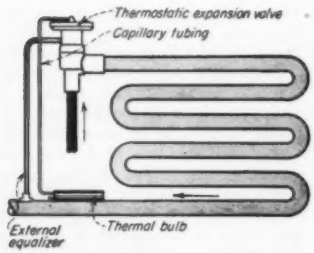
External Equalizer. Large pressure drop through system low side cuts compressor capacity and can also reduce



2 Theromostatic expansion valve for ammonia system; 1- to 19-ton rating



3 Freon-12 thermostatic valve has ⅛- to 1-ton capacity, angle construction



4 External equalizer on thermostatic valve offsets pressure-loss effects

Modern-design expansion valves are neat little packages that do a big job. No matter what kind of system you run you must know what makes them tick. Here's practical know-how that's a real help in large or small plants

By **TYLER HICKS**, *Associate Editor*

expansion-valve capacity. As we saw above, pressure in thermal bulb regulates valve opening by acting against spring and evaporator pressure. With large pressure drop through coil, saturation temperature of gas near outlet is lower because gas pressure is lower.

With lower saturation temperature more superheating of suction gas is needed to hold expansion valve open. This means you are using less of your evaporator to take large amounts of heat from load. System capacity falls.

One way to step up evaporator capacity when pressure drop is large is to use an external equalizer, Fig. 4. This is a tube connected between diaphragm underside and evaporator outlet. Average pressure in evaporator is now on diaphragm underside.

With an external equalizer, valve is almost completely free of pressure-drop effect and responds only to superheat in suction gas. Valve gives full capacity at low superheat. System capacity goes up.

Hookup. Some valve makers recommend that you never use a thermostatic expansion valve without an external equalizer when pressure drop through evaporator is more than 2 psi. Exact location of evaporator end of equalizer depends on evaporator, but usually it is tied in just beyond the point of greatest pressure drop.

With a long single-pass evaporator where all pressure drop is in coil, hookup in Fig. 4 is good. For coils fed from a liquid distributor head, see valve maker. He'll tell you the best way to hook in the valve.

Thermal Bulb. Both internal and external thermal bulbs are used. But since external bulbs are good for most jobs they're more common.

Install external bulb on horizontal run of suction line near evaporator outlet, Fig. 6. Don't put bulb on a length of pipe in which liquid can collect and be trapped. This can give false valve response. System capacity may fall.

Where suction line is $\frac{5}{8}$-in. OD or less, bulb is usually clamped to top, Fig. 6. Clamp bulb on side of line $\frac{7}{8}$-in. OD and larger. Have bulb just above horizontal center line of pipe. Clean pipe and apply a coat of aluminum paint before clamping bulb to it.

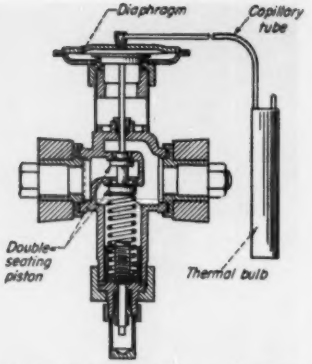
Internal Bulbs. Use these where you need quick response with low superheat. They are also good when suction line has many fittings near the point where bulb should be clamped to line. Don't install near point where liquid can collect.

Automatic Valves. With a fairly constant evaporator load you can use an automatic expansion valve, Fig. 7. It maintains constant suction pressure in your system. Where two or more evaporators are connected to one compressor or where load changes much, a thermostatic valve is usually recommended.

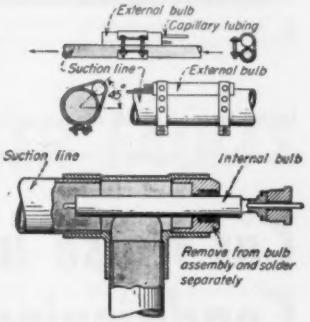
Bottom spring, plus evaporator suction pressure, acts against top springs, Fig. 7. Top-spring tension is controlled by stem at top of valve and may be set for desired suction pressure. When evaporator pressure gets too high, excess pressure is transmitted to bottom of valve diaphragm through equalizing port. Top spring compresses, allowing bottom spring to move pin toward seat. Suction pressure is cut to point where top and bottom pressures balance.

When suction pressure goes below desired point, reduced pressure in equalizing port unbalances diaphragm pressures. Top spring pushes pin away from seat, raising suction pressure to point where top and bottom pressures again balance. When compressor stops, pressure increase in evaporator closes valve tightly.

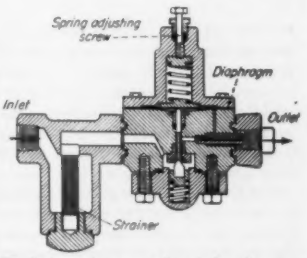
Keep Valves on Job. This article gives only basic facts to guide you. Valve selection and location are other problems you'll run into. Your best bet for help on these is the valve maker. He'll be glad to help.



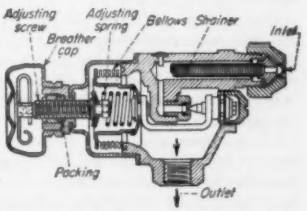
5 Double-seating piston in this valve controls F-12, F-22, methyl chloride



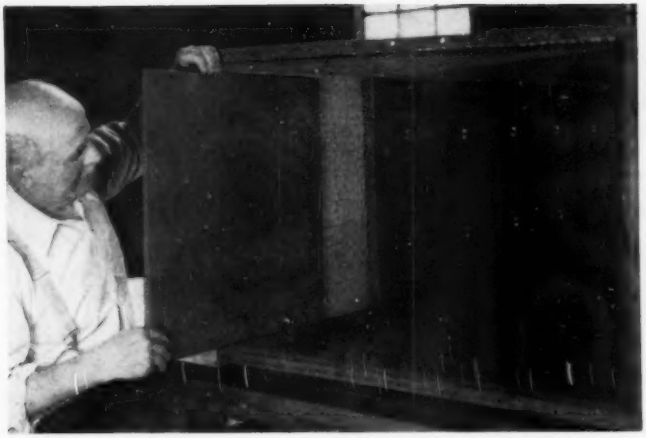
6 *Top*, external thermal bulb clamps to pipe. *Bottom*, an internal bulb



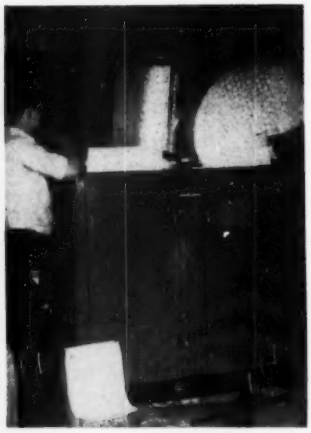
7 Automatic expansion valve for ammonia systems; externally adjustable



8 Automatic expansion valve for Freon, sulphur dioxide and methyl chloride



1 Sound-absorbing material is easily installed in air ducts. Boards cut noise to make air conditioning pleasanter for all. See the text for installation details



2 Complete sound-absorption job helps to improve conditioned-room comfort

Don't let noise kill air-conditioned comfort. Use a good sound-absorbing material in the right places to . . .

Cut Noise in Air-Conditioning Systems

► NOISE IN your air-conditioning system can come from fans, sprays, motors, pumps, air currents, grilles, cross talk between rooms, duct-wall vibration and outdoors. No matter where it comes from if noise annoys people in your building you must get rid of it. Use these practical tips.

Fan Noise. When single ducts supply a number of rooms that need quiet conditions, use a sound-insulated plenum, Fig. 3. Have plenum area at least ten times fan outlet area. So a fan with a 3-ft square outlet should have a plenum with an area 3x3x10 = 90 sq ft.

Line plenum sides and top and bottom with sound-absorbing board or a suitable blanket. Board is nailed to wood strips inside plenum. Egg-crate splitters may also be found suitable in the plenum.

Use a canvas or asbestos connection between fan outlet and duct. This stops fan noise from traveling through duct. You can buy self-vulcanizing adhesive tapes to seal duct joints.

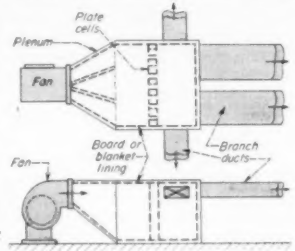
Pumps, Motors. Use flexible mountings so less noise reaches building floors, walls and ceilings. See that machinery room is insulated from other parts of building.

Duct Noise. This comes from air movement, duct vibration and outside noise carried through duct. Good cure is sound-absorbing lining on inside of duct, Fig. 1 and 4. You'll find most ducts lined on four sides, but lining on one side over longer run can cut noise just as much.

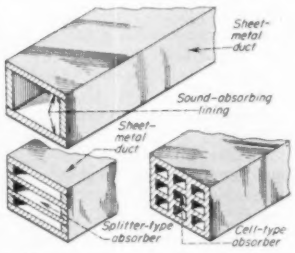
Another way of cutting duct noise is by using horizontal splitters or egg-crate absorbers, Fig. 4. These are good when duct length is shorter than that needed for lining board to cut noise.

Air-Outlet Noise. Pan outlets and grilles may be noisy if they aren't sized right or are put in wrong. Fig. 5 shows several ways you can cut noise in pan outlets and grilles.

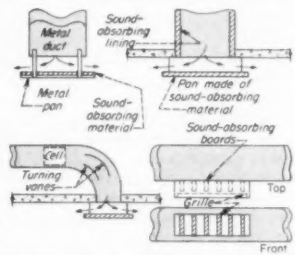
Materials. These are known by trade names. Since you can't pin down duct noises by simple rules, Acoustical Materials Association recommends you have a specialist choose your materials.



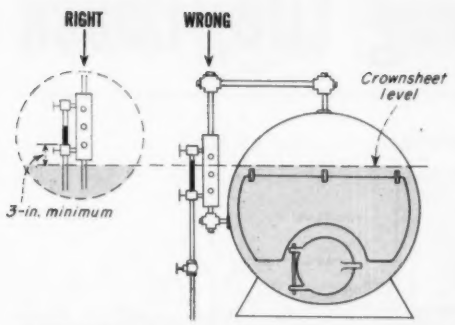
3 Sound absorber and plate cells in plenum chamber keep noise level low



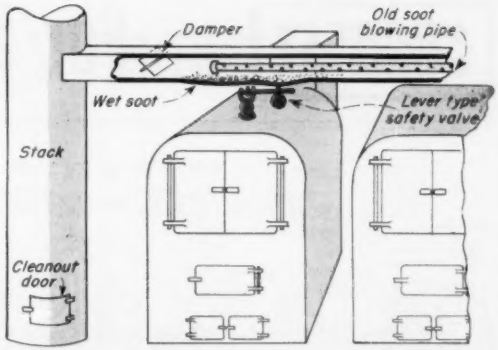
4 Three ways air ducts are lined with sound absorbers to make system quiet



5 Noise in air outlets is reduced by the sound absorbers and cells shown



WATER LEVEL above crown sheet should be 3 in. minimum when water shows at bottom gage-glass nut. How is your boiler?



SAFETY VALVE on this heating boiler is useless. Smoke pipe presses down on lever so it can't lift to relieve pressure

An Old-Timer Points Out . . .

HEATING-BOILER FAULTS

Heating contractor installed new firetube boiler so no water covered crown sheets at half gage glass. An older plant had heating boiler's safety valve blocked by a damaged smoke flue

By **JAMES W BLAKE,** *New York, N. Y.*

► HEATING-BOILER MAINTENANCE is important, but how about knowing what to check while boilers are being installed? Also, how about some things to look for when taking over older heating plants? After operating years around all types of plants, I've run into many boneheaded stunts.

Bum Hookup. I once had a plant where the heating and ventilating contractor hooked up four new heating boilers. After the boiler inspector passed them, I removed the manhole plates on top of the shell and filled the boilers until the water came up to the crown sheets. Then I checked the gage glass. But there was no sign of water in it.

I kept filling and watching the glass. Finally, with water almost up to the top gage-glass nut, there was only ½ in. of water over the crown sheets, wrong sketch. I squawked to the contractor, but he said, "That's OK. Don't worry about it; if we raise the water columns higher, you won't have room for steam in the shell." No doubt that might satisfy some unlicensed engineers.

Now I've been in this business too long to believe that kind of hooey. I called the boiler inspector back. He checked the boiler again. Then he ordered the columns raised so there would be the required amount of water over the crown sheets when water showed at top of bottom gage-glass nut. That was a minimum of 3 in. Needless to say, the contractor made the change.

I've also found motors and machinery installed in inaccessible places. Then from inattention, they caused expensive repairs. But where was the plant's chief engineer while all this was going on?

Dangerous Condition. In another plant I found a perforated 1¼-in. steam pipe in a smoke flue, right-hand sketch. Someone had installed it to blow soot to the chimney. From there, soot was removed through the cleanout door at stack's bottom.

But this scheme didn't work because the pipe was too small for such a large flue. Besides, the steam was too wet. Then the line was abandoned and finally forgotton.

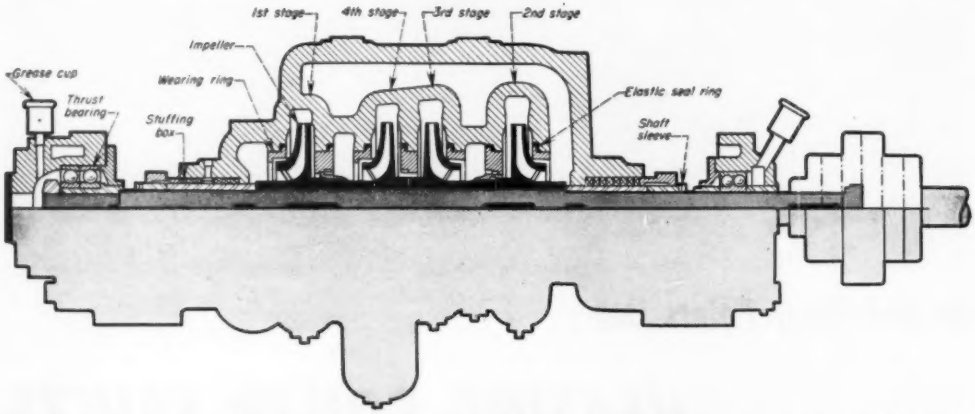
In the meantime, soot piled up in the flue and the 1¼-in. valve leaked condensed steam. That saturated the soot, adding much weight to it. As a result, the flue sank enough to rest on the ball weight of the safety-valve lever. That put that valve out of commission. Fortunately, there were three other heating boilers, all cut into the common main header. So their three safety valves would take care of any excess pressure.

But the story might have been different if the damper regulator had failed —when the other three boilers were cut out, as they were every summer.

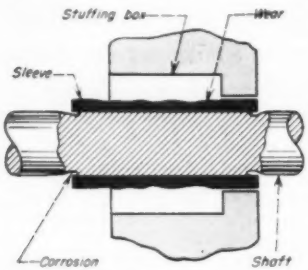
That's why the engineer in charge must check new and old installations. He should know how each piece of equipment will affect operation under varying conditions. I've found you can't depend on the installation contractor. He wants to get the job over cheaply, and as quickly as possible.

OPERATORS' NOTEBOOK 51

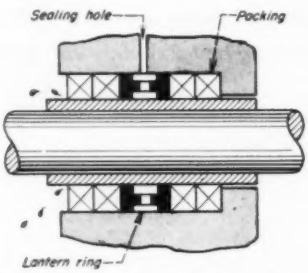
For Long Life, Check



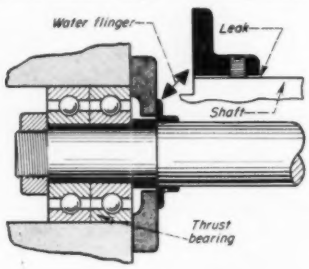
1 Centrifugal pumps take a beating from continuous operation. Open boiler feed—and other vital pumps—once a year for a good look-see inside. Check for wear, corrosion, fractures and cavitation. Poor circulation during the off-pumping periods in high-pressure pumps causes plenty wear. Boiler feed pump's arch enemy is low head of water on suction side from sudden head drop, causing water to flash. Then the pump overheats, wearing sealing and channel rings, or bending shaft



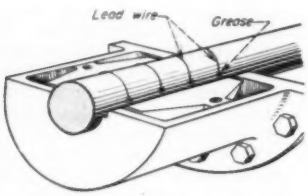
4 Check shaft sleeve through stuffing box for wear from packing. Turn down worn sleeve or replace with new. Look for shaft corrosion at ends of the sleeve



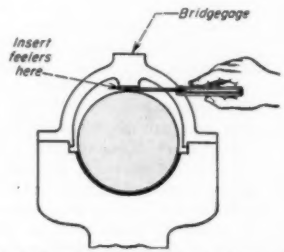
5 Renew shaft packing, align lantern ring with sealing hole. When running, lubricate shaft with slight gland leakage. This keeps air out if under vacuum



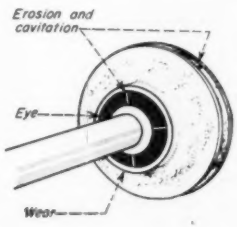
6 Water-flinger ring protects thrust bearing from water leakage. See that ring is snug fit on shaft. If not, seal between shaft and ring with sealing paste



9 For shell-type bearing, check clearance by placing lead wires on shaft and screwing down bearing cap. Mike wires. Remove shims for right clearance



10 On shell-type bearings, take bridgegage readings to find wear on lower half of bearing. Insert feelers between gage and shaft. Rebabbitt if low bearing

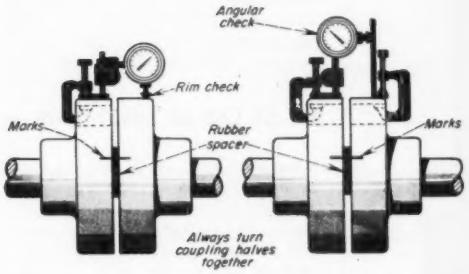


11 Examine impellers carefully for wear at wearing rings. Check vanes for erosion, cavitation and corrosion. Vanes at eye and discharge are trouble spots

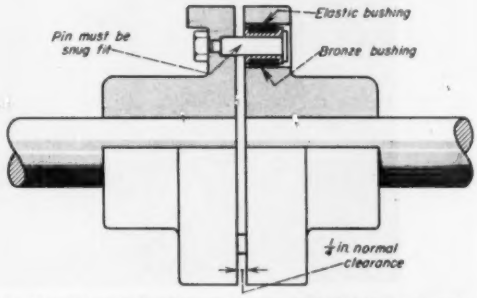
Centrifugal Pumps Annually

By STEVE ELONKA, *Associate Editor*

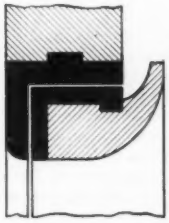
In these times of peak loads, high prices and slow deliveries, it's cheaper to look inside the pumps now than be sorry later

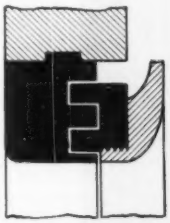


2 Break coupling and align pump and motor shaft while pump and lines are hot, as hot piping tends to throw pump out of line. Align pump again after it's cold. Mark halves, place rubber, rotate halves together and make rim and angular checks

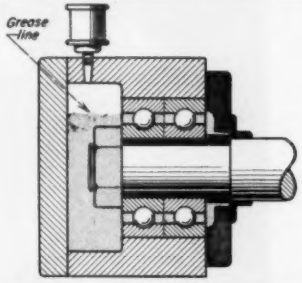


3 If coupling is flexible pin-type, remove all pins and bushings. Clean wearing surfaces of bushings and pins, check for roundness. Lubricate pin and replace elastic bushings that are shot. Check wearing surfaces of all type couplings

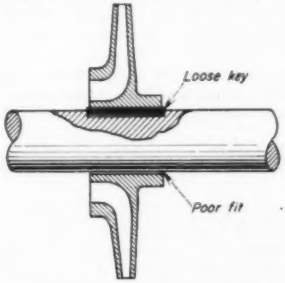

L-shaped wearing ring

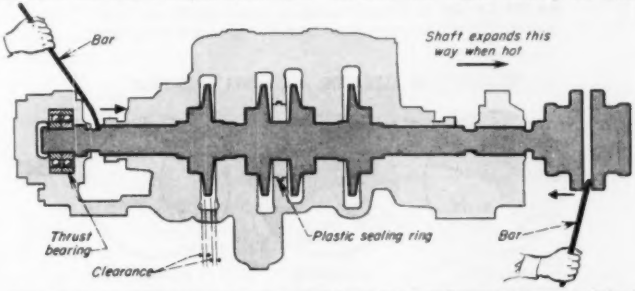

Labyrinth wearing ring

7 Keep clearance between impeller and casing wearing rings close to design recommendations. This opening affects pump's efficiency. Usual clearance should be no more than 0.003 in. for each inch wearing-ring diameter. Never let this opening double the original clearance. Labyrinth type leaks less than L-shaped shown here



8 Clean oil or grease out of bearings. Check for water leakage that knocks bearings out. Clean out all the old lubricant and inspect bearing for wear



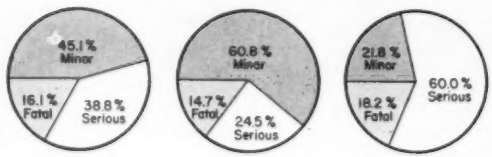


12 Tap key in impeller for being tight. Shaft twisting while under load, expansion, corrosion, or original poor fit makes impeller progressively loose

13 Check thrust-bearing clearance by breaking shaft coupling and barring shaft both ways against thrust bearing. Measure shaft movement from each side of impeller, near tips, housing. Consider expansion of shaft from cold to hot running condition. Before closing pump, renew plastic sealing rings as old ones harden from heat

MAJOR CAUSES of elevator accidents—poor leveling at floors, opening of hoistway door—can be cut with modern equipment

SUMMARY OF ELEVATOR ACCIDENTS 1949-1950



ABOUT 80% of all elevator accidents take place at hoistway and car entrances. Note seriousness of the freight accidents

You Can

OPENING HOISTWAY DOOR

A big chunk of elevator accidents happen every year because unauthorized people open hoistway doors with emergency keys, coat hangers, screwdrivers, or what have you. In some localities emergency-door keys have been outlawed with marked improvement in safety. But there still are scads of elevators equipped with some sort of crude un-

HIT BY CAR OR SHAFT DOOR

Being hit by the car itself is another major accident cause. In this same accident-family, include accidents to people standing on landing when hit, along with the folks struck or caught by a hoistway door or gate. Also there are those caught between car and hoistway-door frame while on a landing. And the people tripping or falling while getting

ACCIDENT AT CAR ENTRANCE

What are some accidents in this family? Well, there's the girl operator whose skirt was caught on the hoistway door-holding device. She was pulled to top of car. With others, an arm or leg stuck out front edge of car and was hit by some projection in hoistway.

Older hand-rope-operated elevators offer their own hazards. Many a person

INJURED IN THE CAR

Lack of car safeties (device stops car on overspeed), or having ones that didn't operate account for a sizable share of accidents. Why do elevators overspeed? Well, take the case of the wooden rails. Here ascending car with wooden rails became wedged. Drum machine continued to operate till wooden crosshead

AUTOMATIC ELEVATORS

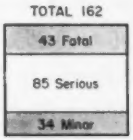
Tangling with power-operated doors accounts for some accidents in self-service elevators. But if a child is trapped between swing hoistway door and car gate, we get the shivers. Often the car moves and the youngster falls down shaft. Couldn't space between door and gate be reduced?

Cut Elevator Accidents

locking rig that is easily tampered with.

Hazard is greatest where door-opening device is simply a round hole in the door. In such cases a screwdriver or rod serves as an adequate key. Accidents can also be traced to doors with no electrical interlock.

Fitting this same open-hoistway theme are accidents that stem directly from improper use of emergency release switches in car. Sure, the manufacturer furnishes these switches with break-glass covers. But often the glasses are soon broken or removed. Then the switches are used to operate elevator with hoistway door open instead of during an emergency as intended. Many elevator codes now ban these switches.



in the car; generally poor leveling.

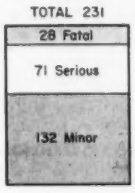
And what does this mean? It's obvious there's a real need for installing adequate and foolproof mechanical and electrical safety devices on hoistway doors, car doors and gates. Besides, there is an educational need to teach those who deliberately knock out safety devices.

For instance, many are injured when caught between car and hoistway door frame—while elevator is operated by manipulating magnet switches on controller in machine room. Others are hurt after car switch is blocked in running position, with gate contact blocked closed. Lad in hallway moves elevator by shorting door contact.

has fallen while unloading freight on a hand-rope job . . . with no door-safety contacts. Meanwhile, the car moved when hand rope was pulled at another floor.

During the 2-year period of this report (see box below) 88 passengers were involved in accidents stemming from lack of car-door or gate protection; 54 were struck and hurt by car or hoistway door. Slipping or tripping while getting off the elevator accounted for 52 accidents.

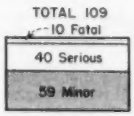
While some of these accidents might be pegged to the carelessness of the injured, a big chunk can be traced right to the absence of a car gate or car-gate contacts on each elevator.



broke and car fell to buffers. In another wooden-rails case, ropes of a drum machine broke at sockets. The safety set but didn't hold on the wooden rails. Likewise there's the car that was hung up in the hoistway while the ropes unwound. When the car was dislodged it fell—and the car safety failed to work.

Even if safeties do work, there's an accident problem. A fractured leg is on record where the safety operated on overspeed, bringing car to stop too fast.

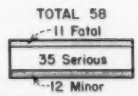
Electrical failures come in for their share, too. For instance, a grounded brake coil will hold brake in open position—or a controller that sticks.



● Info in this article was taken from the *Elevator, Dumbwaiter and Moving Stairway Accident Report 1949-1950*, published by the Otis Elevator Co, New York, N. Y. Original report lists the apparent cause and number of each type accident. Actual number of elevator accidents is low.

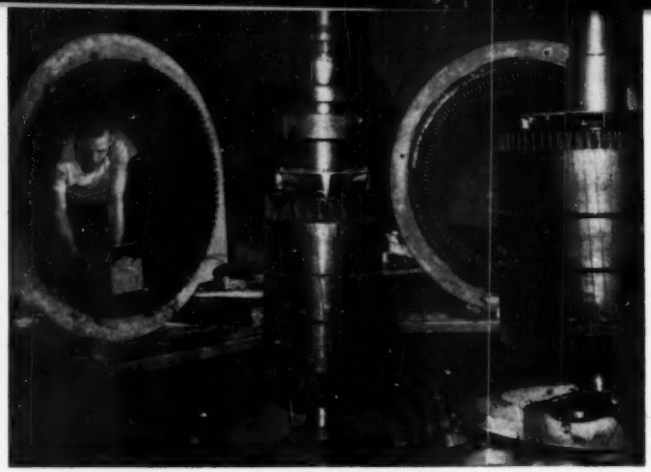
MOVING STAIRWAY

It's surprising that the big portion of accidents on moving stairways happen while the person is actually riding . . . and not when getting on or off as you would suspect. Incidentally, accident reports point to the fact that higher-speed moving stairways don't constitute a greater hazard than slow-speed.



MISCELLANEOUS accidents often involve mechanics while in pit or machine room

When a motor goes sour your best leads often come from looking, listening, smelling, feeling. S Spence in Cheshire, England, shows how to make sense from the senses with . . .



PROBABLE CAUSE of motor troubles can often be found *before* taking the unit apart

. . . Motor Troubles You'll Meet

SYMPTOM — **POSSIBLE CAUSES OF TROUBLE: CURES**

MOTOR WON'T START

1 One phase open; may be blown fuse or poor contact
2 Rotor hitting stator; bearings may be worn
3 Open in stator winding, switch, starter or wiring
4 Low starting torque; check voltage and motor size
5 Excessive friction in driven machine or line-shaft bearings; overhaul, lubricate, check belt tightnesses
6 One phase of stator winding reversed. In this case unloaded motor will come up to speed but hum loudly
7 Windings connected wye rather than delta, or in series rather than parallel. Result is low phase voltage

MOTOR-FRAME OVERHEATING

1 Overloading caused by increased load, fault in driven machine, tight bearings
2 High ambient or too near heat source; improve ventilation, move motor or design heat barriers
3 Poor motor ventilation because of dirt in vent holes; clean thoroughly, install motor vent ducts or replace with totally enclosed motor
4 Low supply voltage; check with local utility. May call for booster transformer or new feeder
5 Winding connected wye rather then delta; motor-starter handle in wrong position or windings connected wrong
6 Poor connection in squirrel-cage rotor
7 Single phasing; blown fuse, poor contact or open circuit in winding, starter, switch or wiring
8 High-resistance ground in winding
9 Few turns or coils in winding shorted out

MOTOR VIBRATES

1 Poor foundation
2 Insecure mounting
3 Rotor out of balance; see *Power*, Nov '50, p 84
4 Pulley, coupling, pinion or fan out of balance
5 Winding partly shorted; check for current balance
6 Coil or coil groups reversed in stator winding. With reversed coils, motor will be noisy too
7 Loose squirrel-cage rotor connections (lights connected in same line will flicker if rotor connections are poor)
8 Poor end connections in wound rotor or bad contact at short-circuiting ring

HOT RING-OILED BEARING

1 Not enough oil in bearing well; leak in drain plug or gage glass, overflow pipe bent or plugged
2 Oil-ring sluggish or not moving; ring tight in slot, ring damaged, dirty oil, wrong-viscosity oil
3 Ring jumps out of slot; fit retaining strip on slot
4 Bearing grooves clogged
5 Oil grooves cut wrong in bearing (See *Power's Handbook of Bearings and Lubrication*, p 87)
6 Bearing too tight
7 End thrust on sliding bearing designed for radial load only; faulty drive, incorrect assembly, or job may call for thrust bearing

HOT BALL AND ROLLER BEARING

1 Not enough clearance in bearing; check whether bearing number and type agree with manufacturer's specs
2 Inner or outer race turning in shaft or in housing
3 Too much grease; pack bearing only about 1/3 full; leave relief plug out for 1 minute after the machine starts
4 Poor grade of grease. Soap and oil separate

HOT BEARING . . . ALL TYPES

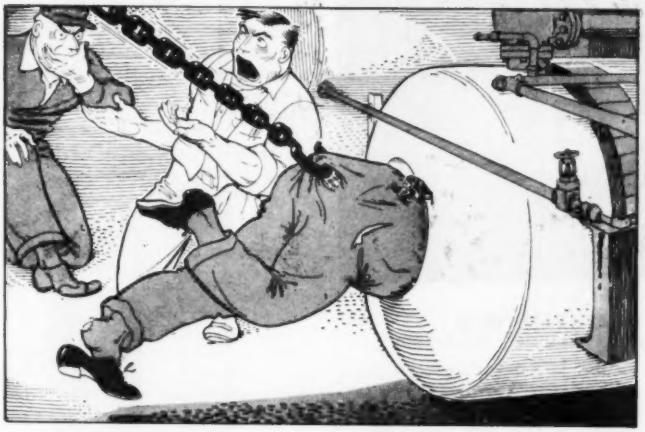
1 Poor alignment of coupling or gear drive
2 Driving belt too tight (Flat belt or V-belt)
3 Belt too far from bearing; reduce pulley overhang; or add another bearing to handle belt load
4 Middle or outer bearings of 3-bearing units overheating. Hot bearing takes more than its share of load; uneven bearing wear, poor alignment

NOISY BALL OR ROLLER BEARING

1 Bearing worn; replace bearing
2 Flattened or chipped ball or roller; replace bearing
3 Fractured cage or race; replace bearing
4 Inner race loose on shaft; build up shaft by metal-spraying, then machine to fit the new bearing
5 Outer race turns in housing; bore and bush end bracket. Or build up to fit outer race of new bearing

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers



THAT'S WHY A CAT HAS WHISKERS

TRAPPED! That's what I was when my helper got stuck in the boiler manhole. I'd finished the washing job and turned the feedwater on through the blowoff pipe inlet. Then I crawled back in to inspect the upper tubes and the top feed line. The line was nearly plugged with scale so I asked my helper to hand me some pipe tools and then come in to help me disconnect it. Suddenly I heard him yell that he was stuck . . . he couldn't move in or out. He got in feet first and was stuck at the shoulders And because of the heat in the boiler, the longer he stayed there, the tighter he got. He just kept swelling up.

I sure was in trouble. The boiler was filling up with water fast. I finally braced myself, gave him a terrific shove and he came loose. But let me tell you, I was worried. After this, whenever I ask for help in a boiler, I make sure the man knows how to get into a manhole. I say he should put both feet and an arm in first, then he'll never get stuck at the shoulders (as pictured).

H A JAHNKE *Milwaukee, Wis.*

We've heard of many ways and many tricks including stripping down to your shorts. Send us yours, new or old, good or bad, grim or humorous.—ED.

DIESEL TIMERS MISSED THE POINT

ANSWERS to the problem on diesel-engine timing (p 136, Aug POWER) overlook one obvious thing. No matter what wear, bad lubrication, wrongly set gears, etc, there may be, the fact remains that cams have so many degrees of opening and so many degrees of overlap. They must have been made that way. There is no other possible explanation.

From the valve-timing diagram (p 142, Nov POWER), I would say this was a supercharged 4-cycle timing setup. Overlap at the top of the stroke and the late after-bottom-center closing of the intake valve indicate deliberately supplied air pressure in the intake manifold.

Answer then must be one of the following: (1) Engine is supercharged, and the manufacturer has supplied an unsupercharged diagram. (2) If engine is unblown, somehow a cam shaft for a supercharged engine has been fitted. (3) Engine was at one time supercharged and the blower was later removed without taking out the late-closing and overlapping camshaft.

G ROSEKILLY *San Mateo, Calif.*

Trapping Superheat Lines

REGARDING Tom Dean's argument about trapping superheated steam lines: the River Rouge main plant of the Ford Motor Co has the superheated lines to the various buildings trapped at strategic points. Open blows are also provided to take care of temporary warmup conditions.

Following quotation from the *Piping Handbook* by Sabin Crocker should at least prolong the argument:

"Single orifices are sometimes used to remove condensate from high-temperature high-pressure steam lines. Where the drains are required only in bringing the line up to temperature, use of orifices is particularly desirable."

L F O'CONNEL *Dearborn, Mich.*

Push or Squeak?

WE HAVE DEBATED about the proper way to lap nozzles into the seats of diesel heads for a long time, and still can' agree. For horizontal jobs, such as we have, where the weight of the nozzle is enough to hold it against the seat, I say 5- to 7-lb pressure is enough. It is then still loose enough to be easily turned and controlled. My partner likes to bear down and finish them off with a squeak.

We are both positive we're right and would appreciate the opinions of experienced hands to settle this for good.

D C & M H

Let's hear from the lapping experts on this push-or-squeak dilemma.—ED.

Engineers From Engineer

I JUDGE a magazine by the number of useful clippings I get from it for my files. Since I got the first issue of *Operating Engineer* and later POWER, my folders have filled up fast. They include, of course, Headwork, Marmaduke and George Edwards.

I started the collection for my own use and enjoyment, but now I have four little engineers who will someday enjoy it too. I should say they're only half engineers because so far they've only learned to tear machinery apart.

In other words, brothers, your magazine is on top of the heap.

GEORGE F NEELY *Vancouver, Wash.*

PRACTICAL IDEAS... *here's the trading post for your*

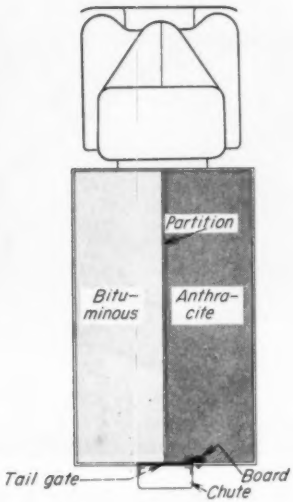
NEW OILERS CUT MAINTENANCE

WE HAVE LARGE MOTORS for driving blowers, pumps and compressors in our large office-building plant. These motors are scattered about in various places and they run most of the time plant is in operation.

Motors were oiled with the drip-type sight oil feeders. Because they were small, I had to assign one man to fill bearing oilers every day. Even at that, one bearing burned out when the sight feeder ran dry.

To prevent that happening again, I installed the glass-cup-type boiler shown in photo. One oiler is placed on each bearing of all our motors now. They have to be filled only once a month, although we check them oftener. There are two holes in the bottom of each oiler, for feeding oil to its bearing. That cuts down chances of plugging. In the two years I've had these oilers, there has been no bearing trouble and much time has been saved in filling oil cups about the plant daily.

A J MILLER *Buffalo, N. Y.*



Uses Coal Truck to Mix Two Grades

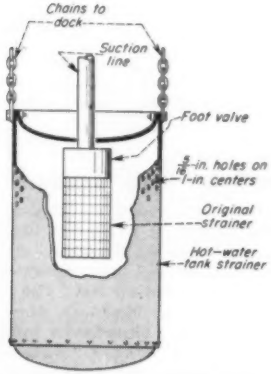
OUR PLANT is in a residential section. We burned caking bituminous coal on a single-retort underfeed stoker. When the fireman broke up the fuel bed with his rake, smoke rolled out the stack. As a result, our neighbors complained.

We could buy fine sizes of anthracite at favorable prices, so decided to burn a mixture of equal parts anthracite and bituminous. But neither we nor the coal dealer had equipment for mixing the two grades of coal. After trying different ways without success we decided to use the coal truck in the drawing so it would mix the coal while unloading.

We put a partition lengthwise in the truck body and loaded anthracite on one side and bituminous on the other. When body rose and tail gate opened, the two coals flowed into bunker.

The anthracite tended to flow out faster than the bituminous. We made the dumping time of the two compartments about equal by bolting a board on the anthracite side of the chute, as shown in the drawing.

ARTHUR HOLT *Atlantic City, N. J.*



Double Strainer Keeps Pump on the Job

ON A PUMP, high-velocity water through the suction strainer soon caused it to foul with trash carried in the river water. To help keep the pump in service we made a large strainer from an old hot-water tank. This tank had been scrapped but it was as good as new for our purpose.

We cut out the rivets from the top of the tank and took out the head. In its center we drilled a hole larger than the suction line, turned the head over and put it on the pipe. Then we put back on the pipe the foot valve on the original strainer.

We drilled 5/16-in. holes on 1-in. centers all over the tank. To complete the job the head with the foot valve and strainer was put into the tank and then held in place by four 3/8-in. bolts.

Two chains were connected, one to each side of the tank. These were fastened to the dock deck, as in the diagram, when the suction line was installed. These chains are used to shake the tank strainer to clean it of trash when the pump is stopped. Now we seldom have to lift the strainer for cleaning as we did before.

GEO G AVANT *Wilmington, N. C.*

Valve Neck Expansion Causes Engine Trouble

AN AIR-INJECTION 4-stroke cycle diesel engine driving a pump began to miss fire. The external inspection did not show the cause, so we started a motor-

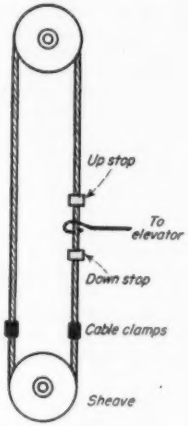
driven pump and shut down the engine.

After the engine had cooled, we started it and put the pump in service. But after running 30 min, No. 3 cylinder began to miss again and the engine overheated. Engine exhaust was black, which showed that the cylinder was getting fuel.

We opened the cylinder and found the exhaust valve neck had been riding on the guide in the cage and holding the valve open. This happened when the engine was loaded and got hot enough to expand the valve's neck. When the engine cooled the neck contracted enough for the valve to close, and then the engine fired on all cylinders.

The valve had come with the engine. Resurfacing, needed to seat the valve properly, had let it hit the guide. We put the valve in a lathe and cut back the neck about ¼ in. Since then we have had no trouble. Reason is that now we turn down the slight shoulder, caused from wear on all valve stems, when we grind in one of our diesel's valves. Details are mighty important.

L R CARRY *Detroit, Mich.*

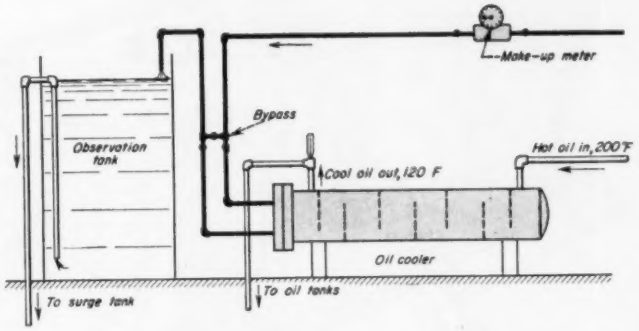


Cable Clamps

Here's a gadget that looks like the devil from an engineering standpoint, but does a good job anyway. We had a lot of trouble with strong-arm operators breaking or bending the stops on a cable-operated controller of our small hoist.

The maintenance man finally put a cable clamp on each cable near the bottom sheave. It gives just enough cushion to foil the strongest operator.

G LINDGREN *Troy, N. Y.*



HEAT EXCHANGER COOLS FUEL OIL

SOME WIDE-RANGE fuel-oil mechanical atomizers burn only part of the oil pumped to them, the rest being returned to the storage tank. At high loads only a small part of the oil is returned, but at light load the amount is large. Load in our plant varies so that light and high load periods are just about equal.

Oil returns at about 200 F and in one plant raised the storage tank's temperature to the danger point. We shut down the boilers because we were afraid the oil pumps might become vaporbound. To prevent this we installed a heat exchanger and connected it so the oil flowed through its shell and the makeup feedwater passed through the tubes, as in the drawing.

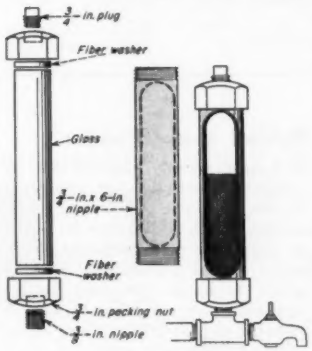
To be sure oil would not get into the boilers in case of an oil leak in the heat exchanger's coils, the makeup discharged into an open tank. Makeup was taken from the bottom of this tank to the surge tank. Any oil in the water remained on the surface in the tank where it could be seen and the exchanger repaired before oil got into the boilers. This is a standard hookup used aboard oil-burning ships for years.

We installed a bypass so part of the makeup can go directly to the tank if the oil becomes too cool We have not had to use the bypass because oil flow and makeup water follow boiler load quite closely.

Even though the heat exchanger was installed to cool the oil in the tanks, heat recovery from the oil more than paid for this new equipment in a very short time. And operation is now ideal.

WALTER J STEINERT *Flushing, N. Y.*

MAKE YOUR OWN OIL-LEVEL GAGE



WHEN YOU NEED an oil-level indicator in a hurry, try making the one shown in the drawing. All parts are readily available around any plant, and with a little work can be quickly assembled. We needed such a gage for one of our forced-draft fans and in a little while assembled the parts shown. All have dimensions marked on them.

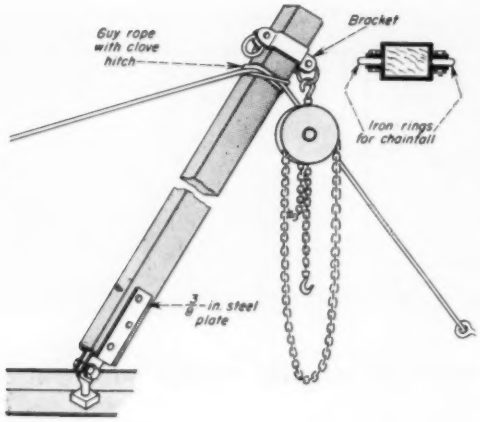
The slot in the pipe nipple is made by drilling and filing so the glass inside it can be seen through the nipple. Tighten packing nuts at ends of nipple just enough to prevent leaking.

E CLARK *Ajax, Ont.*

(*Continued on page* 128)

More PRACTICAL IDEAS

Begins on page 126



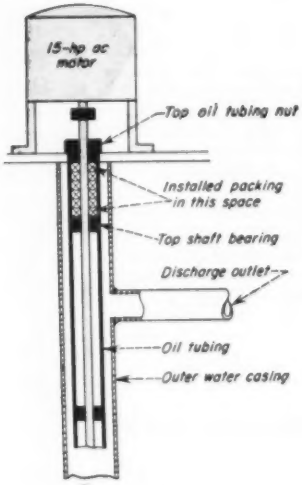
HANDY GIN POLE

WE PLANNED a complete overhaul of all equipment in our four sewage-plant settling tanks. This would mean lowering and raising large sprockets, shafting, bearings, scraper blades and chains. A 20- to 25-ft gin pole could be placed on each tank's bottom. But it would have been cumbersome to move from tank to tank.

The gin pole shown proved successful. By swinging it around, we also used it to lift materials from a truck to the motor support platform.

This type of pole can also be used wherever there is a slot or hole. Or it can be placed in a drilled beam that's stretched across an opening.

F J ARDOLINO *Brooklyn, N. Y.*



PACKED OIL TUBE KEEPS PUMP RUNNING

ON ONE OF our turbine pumps operating against 200-ft head, water leaked into the oil tube. Before this was discovered water got on the motor windings and caused them to fail. As the pump was needed we repaired the motor so we could use the pump until we got a new oil tube and pump shaft.

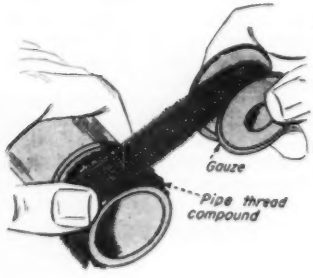
To prevent water again getting in the motor we took out the top tube nut. We then filled the space below it with packing down to the top bearing, as in the drawing. Fortunately this space was quite short so the bearing could be used as the bottom of the stuffing box.

When the nut was screwed down on the packing it held against the 200-ft-head with only a small leak. When leakage became excessive we replaced some of the top packing rings. Because the working space under the motor was short, we could not replace all the packing. The pump operated this way for several months until we got the new parts to make a complete overhaul.

The normally oil-lubricated bearing ran in water. This was OK, probably because on the vertical shaft the bearings were lightly loaded.

JAMES F MAHER *Shiprock, N. M.*

EDITOR'S NOTE: If some of you POWER readers have run into a similar problem with one of your turbine pumps, let us know how you repaired it. We want to know about emergency repairs that kept the pump running until the right permanent repair could be made.



Thread Leak Stopper

EVER HAVE a newly threaded joint, in a large-size water pipe, drip—regardless of how tight you pull it up? Well, here's a sure cure. Just dope the thread up good with pipe compound. Then wrap a turn of medical gauze bandage around the thread. The pipe compound holds the gauze to the threads, while it keeps the compound from wiping off.

Make up the joint again and screw it up tight. This time you have a fit that stays tight until hell freezes over.

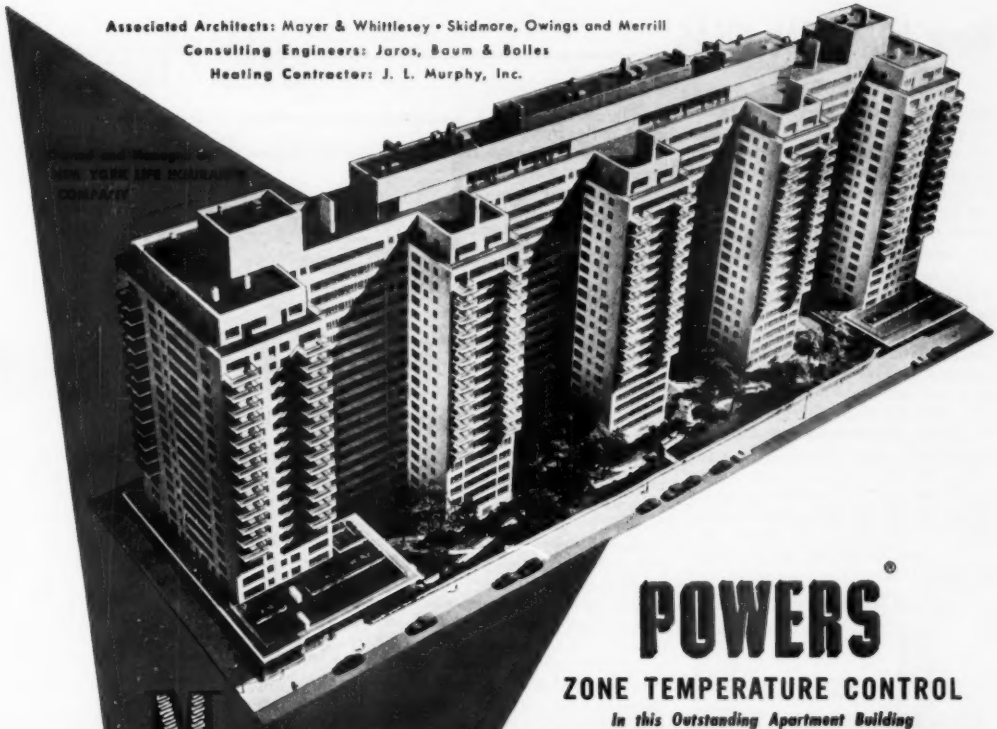
T. TRAIL *Catonsville, Md.*

Blower Bearing Ruined

TWO LARGE steam-turbine blowers were connected to a common header, with a shutoff valve in the discharge of each unit. So both sets would do about equal work, one was operated one week, and the other the next. That's good practice.

(*Continued on page* 130)

Associated Architects: Mayer & Whittlesey • Skidmore, Owings and Merrill
Consulting Engineers: Jaros, Baum & Bolles
Heating Contractor: J. L. Murphy, Inc.



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Assures Comfort, Dependability, Lowest Maintenance Cost

Temperature of hot water supply to convectors in this modern building is controlled by a Powers **MASTROL** System.

How It Operates—A Powers Master Thermostat with its sensitive bulb in a special housing for sun-wind effect and outdoor temperature is located on outside wall of zone being controlled. It operates in conjunction with 4 Room Thermostats on the 4th, 9th, 14th and 19th floors of each zone through Averaging Relays to establish the control point for Series 100 Sub-Master Controllers. A manually operated switch on the main control panel is provided to raise or lower the control point when desired.

A program clock automatically reverts the controls to night operation during which period the outdoor Master Thermostat readjusts Series 100 Sub-Master Controller to a lower control point than used during day operation. Other types of Powers controls regulate various fans supplying heating and ventilating to other spaces in the building.

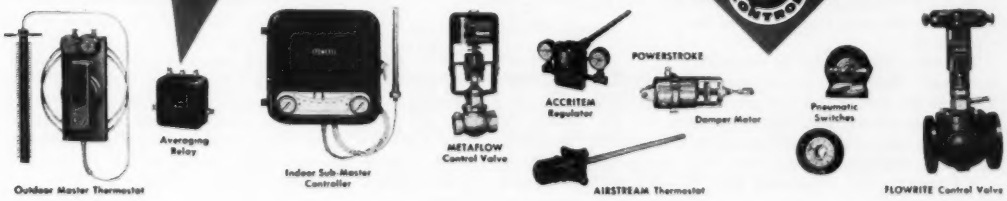
Experience gained by Powers in all types of prominent buildings will be helpful to you. When problems of temperature and humidity arise, contact our nearest office.

THE POWERS REGULATOR COMPANY, Skokie, Ill.

Type D Room Thermostat

(a77)

OVER SIXTY YEARS **OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL** **OFFICES IN OVER 50 CITIES**



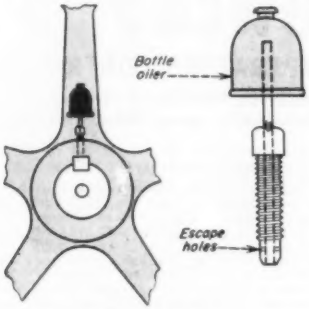
Begins on page 126

One day trouble developed. The set in operation had to be shut down and the spare started without interrupting the blast. The assistant engineer closed the steam valve on the first blower but did not close its discharge valve. As a result, the spare blower discharged into the faulty one and ran it backward.

The engineer did not notice that the unit had stopped, and reversed very quickly. Thinking that it did not stop, he again tried to close the steam valve, which was closed tight. Wrecking the machine was prevented by failure of the oil pump, which was designed to run in one direction only. When this pump failed the main bearings quickly overheated and seized.

By good luck, the spare unit ran until the damaged machine was ready for service again. Automatic shutoff valves were then installed on the blowers' discharge pipes so reverse rotation could not happen again.

J B MULLINS *Chicago, Ill.*



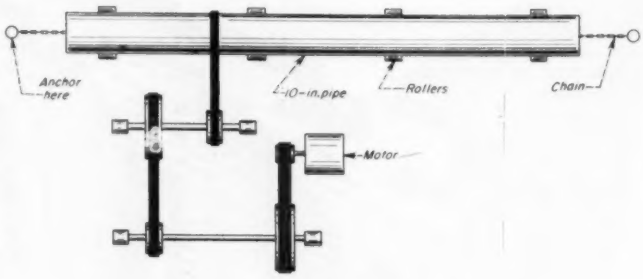
Bottle Oilers Help Remove Tight Pulleys

WE HAD TROUBLE taking pulleys off shafting because they had been in use several years and were rusted in place. Penetrating oil helps loosen up the rust, but there is usually little time to use this oil after we start taking down the shaft.

Now, several days before the pulleys are to be taken from the shaft, we take the setscrews out of the pulley's hubs. We drill a hole through the setscrews from end to end, as in the drawing. The hole in the setscrews' head we thread for a bottle oiler.

The oilers are installed on the pulley hubs and filled with penetrating oil. Then, by the time the pulleys are to be removed the oil has had time to do its work. This helps a lot in getting pulleys off shafts without wasting our time.

N FORMBY *Montreal, Que.*



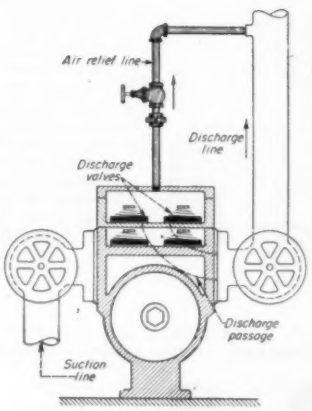
CHAIN SMOOTHS INSIDE OF PIPE

WE HAD TO REPLACE a cotton-conveying pipe under a heavily traveled road. This pipe was a galvanized sheet-metal type, inside a 14-in. cast-iron one. The sheet metal had rusted through and the cast-iron pipe had settled. That gave us a tough problem.

Because of the cast-iron pipe's condition, pulling a new sheet-metal lining in it seemed a risky job, so we did not try it. We had some 10-in. steel pipe that we used but it was quite rough on the inside. We smoothed it as indicated in the diagram.

Pipe sections were 33 ft long. We placed these on rollers and rotated them by a small motor through a system of belts. To smooth the pipe we stretched a heavy chain along its bottom and anchored it at each end. When the pipe was rotated the chain rubbed it smooth on the inside. To speed up the job we fed crushed stone and sand into the pipe and it gradually worked through to the other end. In this way we smoothed the surface of three sections of pipe. These were connected together as they were pulled through the 14-in. line. This method saved us money.

N FORMBY *Montreal, Que.*



Air-Relief Line Corrects Vacuum-Pump Trouble

A SIMPLEX condensate-return pump on a low-pressure heating system had to race to hold vacuum on the system. Test showed the water being pumped was not too hot, and there were no serious air leaks. Pump valves and packing were in good condition.

When looking at the pump drawing we saw the discharge passage was downward from the discharge-valve deck. From this we got the idea that maybe air was being trapped above the valve deck. Then on the suction stroke some of the air leaked back into the cylinder. Expansion of this air in the cylinder made it difficult for the pump to hold a good vacuum.

To correct this condition, we installed a connection from the discharge pipe into the top of the valve-chest cover, as in the diagram. After we made this connection the pump could, when operating slowly, hold a 10-in. vacuum on the heating system.

The valve placed in this vent line is for closing whenever we overhaul the pump's liquid end. With discharge valve also closed, system can't drain back through the pump while we overhaul it. This line solved our problem.

ARTHUR HOLT *Atlantic City, N. J.*

puts the HEAT on heat exchangers

By changing to Yarway Impulse Steam Traps, an oil refinery reports much hotter steam in their heat exchangers **—plus two other important extras:**

(1) They were able to operate the plant with 6 boilers instead of the 8 formerly required.

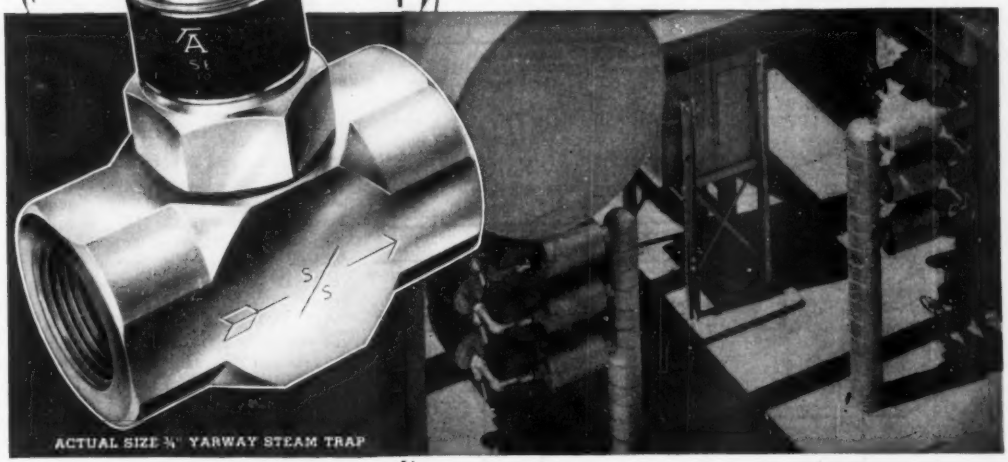
(2) Three men formerly required to service old-type traps can now be used for productive work.

Significant sidelight—these Yarway traps are operating under severe conditions, many outdoors with temperatures often below zero.

Plant after plant is standardizing on Yarway Impulse Steam Traps because Yarways are designed to deliver the most premium B.T.U.'s at top temperatures into your process or product. **They get equipment hotter, sooner . . . and keep it hot.**

Other reasons—small size, easy installation, good for all pressures, only one moving part, low maintenance, low price.

Buy your Yarway Impulse Steam Traps from the nearest of 216 distributors. For name, write us.



ACTUAL SIZE ¾" YARWAY STEAM TRAP

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

FREE OFFER. Don't take our word for it. Test Yarway's advantages in your own plant, without cost or obligation. Drop us a card or letter—a trial trap will be delivered promptly.

YARWAY the steam trap

designed with more production in mind

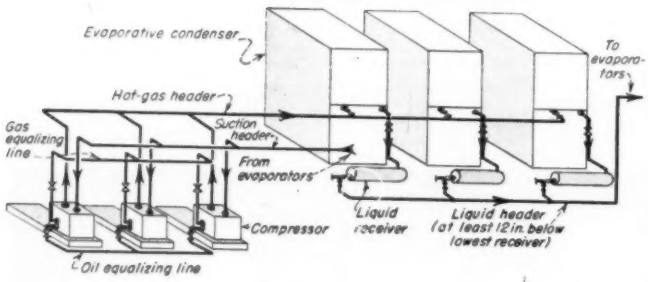
PLANT PROBLEMS... *put your know-how to work*

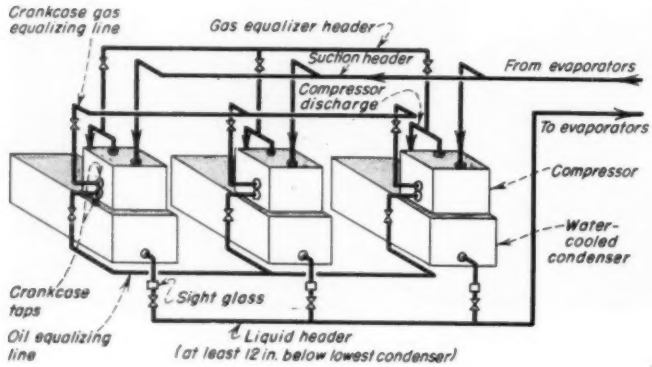
HOW CAN WE CONTROL FREON COMPRESSORS?

HERE ARE THE FACTS: We have three Freon refrigeration compressors that serve three separate cooling loads on one floor. Sometimes load becomes unbalanced, one area being cool, others hot. There's no way of running compressors so they help each other. Most trouble comes during the summer.

Since total refrigerating capacity is more than enough to handle load, we've been wondering if a common header on high side would give flexible control. Is a common receiver also needed? What are the advantages of this method? Is there a better way of hooking up these compressors? What hookup gives best economy?—*RN*

Here Are the Answers





SKETCHES SHOW HOOKUPS for evaporative and watercooled condensers. If *RN*'s three systems run at same suction temperature he can use either hookup.

With watercooled condensers make hot-gas and liquid headers equal in area to sum of area of branches. Set the three compressors so crankcase taps are at same level. Have equalizer branch same size as tap with header equal in size to largest tap. Put shutoff valves in each line to and from compressors, condensers and receivers.

Call in a control manufacturer to recommend best way of varying output with the new hookup to be used in plant.

DR MARCELLO GIOMI
Albuquerque, N.M.

GOOD POINTERS. I've run several refrigeration plants having compressors paralleled. Here are pointers often overlooked when putting in jobs of this kind:

(1) Arrange piping so oil returns evenly to all machines. (2) Use balance lines to equalize pressure differences between compressors.

(3) Compressors must run at same suction pressure. (4) You must use two equalizer pipes on compressors fitted with two equalizer tappings. (5) Some newer compressors use only one equalizer line. If compressor has an oil check valve, be careful to watch valve when starting compressor after a long shutdown. Oil may be blown out of crankcase before gas equalizer relieves.

(6) Have single-pipe equalizer horizontal. If compressor tappings are at different heights, build up foundation of low unit so line is horizontal. (7) Keep branch lines between suction header and different compressors equal in length, and if possible, use same size and type of fitting in each branch. (8) Avoid pockets where oil can accumulate.

(9) Equalize compressor discharge lines when individual condensers are used for each compressor. Connect equalizer to gas line ahead of condenser. Then individual condensers work as a single large unit.

(10) Join liquid lines from individual condensers into a common liquid header below the condensers. Keep liquid header well below them. (11) Use only one water-regulating valve for individual condensers so flow splits beyond valve, an equal quantity going to each condenser.

(12) In Freon systems, size pipes so gas velocity is at least 750 ft per min in horizontal lines and 1500 ft per min in vertical lines in which gas rises. Then oil movement through system will be rapid enough to prevent accumulation in piping.

(13) Don't run one compressor of a parallel system continuously. Switch from one unit to another so each compressor logs about an equal number of running hours. This keeps wear about the same in all machines. In one plant with an air-conditioning load we switched machines at 10-day intervals with good results.

ROBERT MEEKER *Detroit, Mich.*

PARALLELING TRICKY. Freon just loves oil and soaks it up. When compressors are paralleled you must be careful to

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

see that oil level in all units stays equal. Low oil in one compressor may cause wear of shaft seal, allowing loss of Freon. Too high an oil level allows oil to slug into suction, damaging valves.

My advice to *RN* is: Inspect compressors. If crankcases have oil-level sight glasses and connections for oil-equalizing lines, he can parallel the compressors. Don't drill holes in crankcases for oil-equalizing lines. You're likely to have serious trouble.

It looks to me as though *RN's* best bet is to buy another compressor to carry his extra load. He can then adjust his loads to suit system capacity.

A M PALMER *Brooklyn, N.Y.*

PARALLELING OK—If evaporators are large enough, condensers and receivers equalized, piping is of right size, total machine capacity ample and job properly engineered. Also, of course, crankcase-oil levels must be equalized.

Set pressure controls in a staggered arrangement so compressors cut in and out or unloaders function to change machine capacity at the right time.

MELVIN EVANS *Chicago, Ill.*

NOT ENOUGH SURFACE in evaporators probably causes *RN's* trouble unless suction pressure on one or more of his compressors is too high at peak load.

Paralleling isn't economical unless evaporating temperatures are about equal. With unequal temperatures power consumption goes up.

Use common suction and a common discharge header when paralleling. Single receiver is also advisable. If *RN* has enough condensing capacity but must pay a high price for water, he can switch to counterflow cooling with three condensers in series. Or he can use one condenser in series and two in parallel to remove superheat with warmer water.

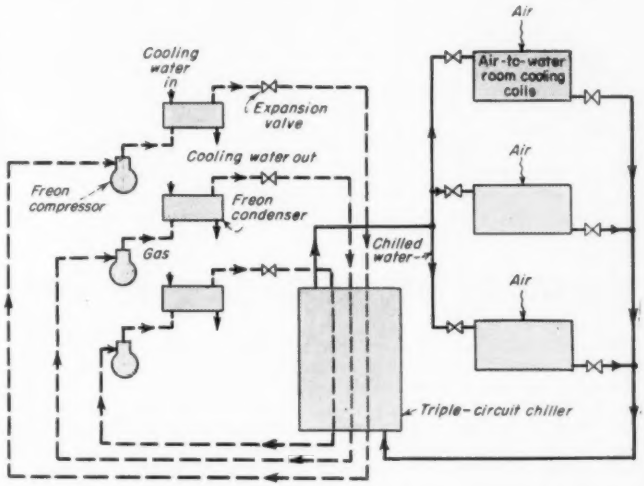
R T MORGAN *Lunenburg, N.S.*

DON'T PARALLEL if there's a large temperature difference in the three systems. You'll have to run all three compressors at low pressure needed for coldest system.

RN can parallel his compressors if all three evaporators run at nearly the same temperature. Tie three compressors together with a common discharge header and a common suction header. Use a single receiver.

Set compressor controls for slightly different temperatures so all units don't start and stop at the same time. Parallel system is better than present hookup because you can shut one compressor down for repairs and still have the other two to work with during repairs.

IRA A BUTCHER *Cincinnati, Ohio*



USE CHILLED WATER. This gives finer control than direct expansion. Compressor can be automatically shut down by thermostat in room when temperature reaches right level.

Use a triple-circuit chiller for chilled water, as in sketch. Chiller can be specially designed for this job. Remember that proper baffling is needed for efficient heat transfer in the chiller.

Common header and receiver aren't too good because crankcase contamination is likely. Chilled water is better; it avoids this trouble and others that pop up in systems fitted with common header and receiver. I've seen it work well on many different jobs.

A J BREUGELMANS *New York, N.Y.*

For your two new problems from Power readers, turn to page 136

PLANNING MISTAKE, made during plant design, is cause of *RN's* trouble. He should install a common suction manifold, a receiver large enough to hold entire refrigerant charge and a liquid-line manifold.

Use automatic backpressure regulators on suction line ahead of manifold if evaporator temperatures are unequal. Install suction manifold and liquid-line manifold. If plant now has condenser-receivers, he may not need a new receiver. Connect these units with an equalizer to keep liquid level the same in all the units in system.

JOHN P MULVEY *Yonkers, N.Y.*

THERMOSTATIC CONTROLS on evaporators permit accurate temperature regulation. Install these after paralleling the system, and room temperatures will stay at right level.

LOYAL HAGGARD *Cincinnati, Ohio*

ONE RECEIVER, into which all liquid from condensers flows, did a good job in our plant. Liquid and gas headers together with three limit controls, one for each compressor, allowed us to carry widely varying loads at good efficiency. Limit controls were set to stop compressors in 5-psi steps. If *RN* uses this setup, he'll also need three high-pressure cutouts, if his compressors don't have them now. Cost is low.

J R HINES *Goose Bay, Labrador*
OLIN L BRAGE *Cowiche, Wash.*

COMMON RECEIVER isn't needed if the three *RN* now has are on the same level and equalizing lines are connected between them. If they aren't on the same level a common receiver is needed be-

(*Continued on page* 134)

More PLANT PROBLEMS

Begins on page 132

cause difference in elevation will cau. starving of highest receiver. Also, noncondensable gas may collect in liquid line. Another advantage of a common receiver is that less Freon is needed because only one seal must be kept instead of three seals.

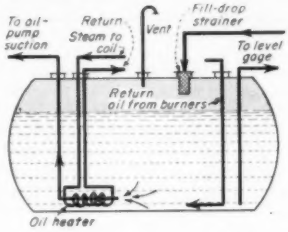
M H OSTRANDER *Chicago, Ill.*

FIT EQUALIZERS to top and bottom of three receivers if compressors are close to each other. Run a common liquid line to the three evaporators. Fit liquid solenoid valves ahead of the expansion or float control valves. Run a common suction line to all compressors with suction solenoids on each branch.

Install pressure-control switches on each compressor and set at different cut-in pressures so units start as load builds up. Have room thermostats control solenoid valve opening and closing.

With one room run as a freezer *RN* will have more problems. I suggest he see maker of his compressors.

H S STILES *Dallas, Texas*



REPIPE TANK as in sketch. Burner return and suction lines are at opposite ends of tank with fill line at return end. Hookup helps keep sludge in suspension and much of it is burned with fuel without excessive clogging of strainer.

We've had good luck with sludge solvents after changing tank piping as shown. Don't use overdoses of solvent because strainer and pump maintenance may jump up, raising costs.

R H VOGELMANN *New York, N.Y.*

FUEL-OIL ADDITIVES do good job for us. We use only 53 gal of one type to treat a 420,000-gal tank having one to two feet of sludge on the bottom. Sludge is burned after being worked into solution with the oil in the tank.

E W HAMILTON *Abilene, Texas*

HEAT OIL with coil-type heater on the high suction. We put this type in our tank a short time ago and it works fine. Use the high suction for normal load, low suction for light load. Put some additive in tank to help burn sludge-oil mixture in regular burners.

S A AUTIO *Orange, Mass.*

THREE METHODS. Easiest way to clean tank is with a bucket after all oil has been pumped out. Or sludge solvent can be poured into tank and the sludge agitated to mix it with the oil. Burn mixture. Third way of getting rid of sludge is to use a hand pump to get it out of tank. This works well and is easy to apply when tank is empty.

A J BREUGELMANS *New York, N.Y.*

NOT UNUSUAL. We have same trouble and get around it by having our tanks cleaned every five years. Or *AHP* can clean tank himself, heating sludge or adding kerosene to it before pumping out of fuel-oil tank.

E M MCGRATH *Chicago, Ill.*

BURN SLUDGE. One way to do this is to pump sludge to a tank fitted with large heating coils. Mix sludge with a sludge-free oil and heat mixture. Use a steam-atomizing burner with a good strainer

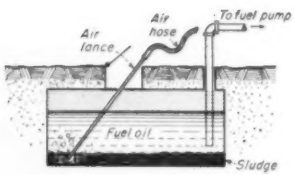
HOW CAN WE TAKE SLUDGE FROM FUEL TANK?

HERE ARE THE FACTS: A 15,000-gal underground tank for fuel-oil storage is buried back of our boilerhouse. Trucks deliver No. 6 oil, unloading 4250 gal at each trip.

Lately we've noticed a resistance or soft cushion every time we drop a measuring stick to tank bottom. Tank doesn't have a drain so we're scratching our heads trying to find a way to get rid of sludge. We tried an emulsifying oil to thin it. This was put in with every truck load of fuel oil, but we still have sludge.

How can we remove this sludge? Is pumping OK? Should it be heated before being pumped? Can we burn it under our boilers? If not where can this sludge be dumped safely?—*AHP*

Here Are the Answers



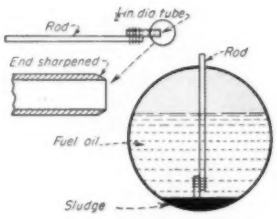
AGITATE SLUDGE with an air lance as in sketch. Move lance along tank bottom from time to time. Agitated sludge mixes with oil and is pumped to burner.

OLIN L. BRAGE *Cowiche, Wash.*

PUT A MANHOLE IN TANK, if it doesn't have one. Clean sludge from tank with a bucket on the end of a long wooden handle inserted through manhole. Don't allow anyone to enter tank before it has been completely ventilated.

If a manhole can't be put in tank use a diaphragm pump to remove sludge from tank bottom. Heat sludge before pumping. Strain through cloth and return remaining oil to tank. Neoprene hose of large diameter is good for handling sludge pumped from tank.

IRA A BUTCHER *Cincinnati, Ohio*



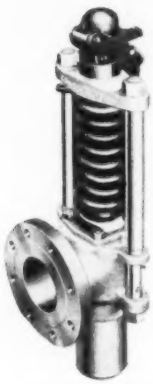
MEASURE SLUDGE DEPTH with tube attached to rod shown in sketch. If sludge is thick, a core of it will stick in tube. With a depth of only a few inches that doesn't interfere with pumping, tank can be used until depth builds up to the danger point. When this happens clean tank, removing all sludge.

Have core analyzed in a laboratory before cleaning tank. Then you'll know if an emulsifier will do a good job, or if hand cleaning is needed.

A M PALMER *Brooklyn, N.Y.*

DIRTY JOB. Hand cleaning is dirty work and takes too much time. Use a sludge solvent regularly. It does a fine job if of the right type for sludge in tank.

AL HUNNEWINKEL *Woodstock, Ill.*



Safety valves with greater discharge capacity and shorter blowdown are essential on high-pressure, high-temperature steam generating equipment. Consolidated *Maxiflow* Safety Valves release the greatest amount of steam that can flow through a given size inlet with imposed entrance conditions.

They provide other functional advantages. Tightness is permanent: thermodisc seating eliminates distortion due to thermal stresses–temperature differentials are quickly equalized. The forged steel through bushing has precision-machined surfaces for better steam flow, greater resistance to erosion, corrosion. Blowdown can be controlled with the externally adjustable "micrometer" trim ring while the valve is under pressure. By combining proper compensation with metals of low coefficients of expansion, the popping point is retained.

Get complete safety and service feature data; also capacity tables. Write for Consolidated *Maxiflow* Safety Valve Bulletin 707.

CONSOLIDATED 1879 U.S.A.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.
MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

More PLANT PROBLEMS

Begins on page 132

ahead of it. We put in a special fuel-oil pump below tank to handle mixture. Pump piping is oversize and arranged for easy blowing out.

M G Bittel *North Hills, Pa.*

HAVE OIL CHECKED to see it doesn't have too much sediment or water. Oil company will do this for you. Heat sludge and pump to tank truck or other place where it can be disposed of safely.

Melvin Evans *Chicago, Ill.*

OUR FUEL TANK has a capacity of 52,000 gal, was built in 1924, and has been filled with different oils—No. 4, 5, and diesel oil. Tank has never been cleaned. It now has 20 in. of sludge so thick you can hardly push a pipe through it.

I took a sludge sample, which the oil company tested. In it they found sand, asphalt and other materials. Such a high temperature is needed to soften the sludge that it can't be put to any good use. When we decide to clean our tank, we'll be careful to dispose of sludge in a place where it won't harm underground- or surface-water supplies.

Here are some pointers we've found helpful in tank cleaning. Ventilate tank thoroughly before sending a man in. Use a fan for this job and keep it running while man is in tank. Station a guard outside to watch man inside. We fasten a rope around man in tank so he can be pulled out if overcome by fumes.

W M Byars *Tulsa, Okla.*

CLEANING FIRM specializing in fuel tanks will remove *AHP's* sludge at low cost. After tank is clean have cleaner recommend best solvent for job.

Art Cannon *Laurence Harbor, N.J.*

NEARLY ALL NO. 6 OIL contains sludge. In our plant we handle hundreds of thousands of barrels of No. 6 oil annually. Our foreman in charge of pumping says, "Don't worry about sludge in the bottom of No. 6 fuel-oil tanks. If you keep end of pump suction pipe close to tank bottom, you will pump sludge out as fast as you need to."

By mixing sludge with enough fuel oil *AHP* can burn it under his boilers. Agitate sludge with compressed air to mix it with oil. Don't agitate for too long a time at first because you may get more sludge than burner can handle. Oil refineries have used compressed air for compounding. They get fine results.

Sludge in tank bottom won't interfere with gaging if outage gages are taken.

Burton W Wheeler *Rockland, Mass.*

YOUR NEW PROBLEMS

1 How Can We Move Flyash to Dump?

We recently installed a dust extractor in our 14,000-kw steam plant. Fuel is low-grade lignite with about 30% ash. It is fired by pulverizers.

At present we move dust from extractor to our dump by hand truck. When there's a wind the dust is blown out of trucks, causing a great nuisance.

One of our engineers suggested putting in a pneumatic conveyor to move dust from extractor to the dump. Water sprays in dump will wet down dust and stop it from being blown around the plant.

The one catch is that water is scarce in our plant. Is there any other way of handling this dust? What is the best way to convey up to 50 tons of dust per day without wasting water? Can water used be reclaimed?—*RW*

2 What's Best Way to Check Rectifier?

We use several selenium disk-type rectifiers to change 24-v ac to 18-v dc. These units have been running for four years, eight hours per day.

De output of some of our selenium rectifiers has fallen more than 50%. My understanding is that disk-type rectifiers age about 5% during the first 10,000 hr, but after that stay practically constant. Our experience doesn't confirm this aging.

We've inspected all the units with low output, but they appear to be in excellent condition. We haven't tested them because we don't know of any reliable methods.

How do POWER readers check for faults in rectifiers of this type? What kind of faults are most common? How could we recondition these units so they give better service?—*HT*

Will you help readers who have sent us their problems? Extra pay for answers accompanied by photographs or sketches.

SAME TROUBLE popped up in our plant a year ago. Our 8000-gal tank was so loaded with sludge we couldn't pump oil to burners.

Thin oil and patent sludge solvents didn't work so we called in our oil supplier. He advised pumping tank out and cleaning.

A road-oil truck fitted with pump and heater pumped out top 4000 gal. Oil was in good condition so we got full credit for it. Remaining oil in tank was pumped, heated and recirculated by road-oil truck before going to a tank truck. This oil was credited to us as slop-oil.

Trained oil-company man entered tank and quickly cleaned small amount of oil left. He also inspected tank interior. Since this cleaning we haven't had any trouble with sludge.

We think cure is cheaper than prevention. Incidentally, our sludge proved to be heavy ends that had built up over 11 years during which we passed 1.5 million gal of oil through tank.

R W Robbins *Schenectady, N.Y.*

EMULSIFY SLUDGE with right fuel-oil additive. To get under sludge, be sure additive is heavier. Before using additive, test sludge to see that additive dissolves it. You can make this test in a saucer.

Then fill tank with No. 2 distillate, adding ample amounts of additive. No. 2 oil seldom has sludge so additive can act on sludge in tank. If there's a large amount of sludge in tank two loads of No. 2 and additive may be needed.

Gordon Whittaker *Kansas City, Mo.*

GET IN TANK and clean by hand after all oil is pumped out. Most sludge is too heavy to pump. Hand cleaning gives best job. After tank is clean use sludge emulsifier regularly.

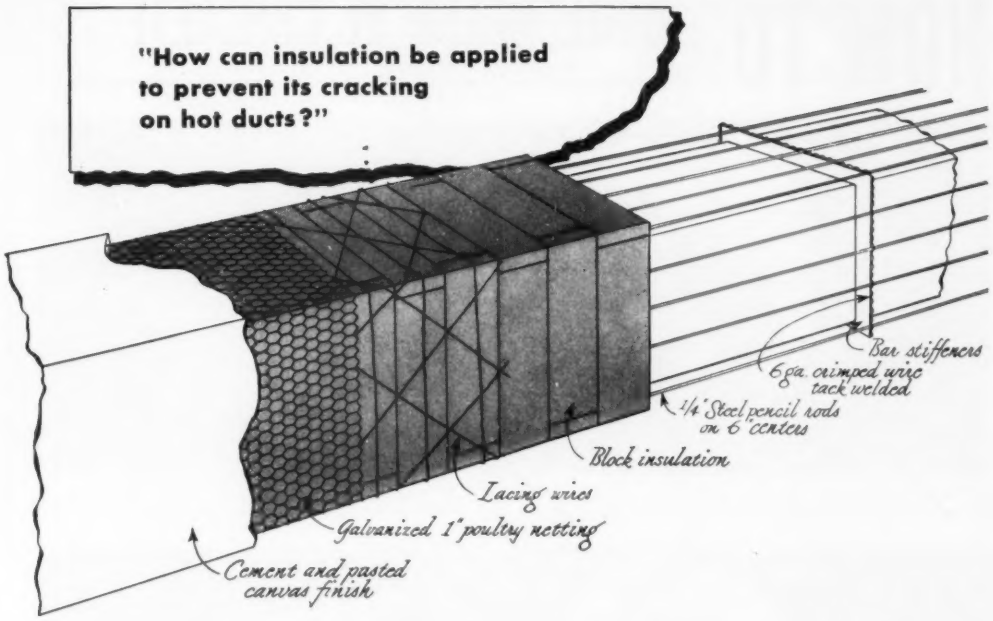
Theron Taylor *Ayer, Mass.*

RIGHT ADDITIVE used in proper way will cure sludge troubles in some tanks. Where sludge is caked on tank bottom *AHP* will have to clean tank by hand before using additive.

In my plant I found that easiest and cheapest way to keep sludge out of system was by having a tank-cleaning firm take over the job. Our tank is inspected regularly by their men; any needed cleaning is done when tank is empty. We have several fuel tanks so it's always possible to burn all fuel in one before switching to another. Cost is low; results are excellent.

J M Good *Chicago, Ill.*

We have been asked:


"How can insulation be applied to prevent its cracking on hot ducts?"
Bar stiffeners
6 ga. crimped wire tack welded
1/4" Steel pencil rods on 6" centers
Block insulation
Lacing wires
Galvanized 1" poultry netting
Cement and pasted canvas finish

A plant engineer wrote to us recently and outlined this problem — "We plan to insulate a metal breeching which operates at a temperature of 400° F. How should the insulation be applied to prevent its cracking due to the expansion and contraction of the duct underneath?"

In answering this question, we made the following recommendation: We suggest insulating this duct with blocks of Armstrong's 85% Magnesia, 3" thick. Its top temperature limit of 600° F. allows a safety margin of 200° in this application. The blocks are applied as shown in the drawing above. First, the stiffeners are bridged with ¼" steel pencil rods on 6" centers. End joints should be staggered at least 18" apart, with all butting ends tack welded. The rods are held in place with 6-gauge crimped wire, tack welded to the stiffeners on approximately 6" centers. Care should be taken, however, to prevent the rods from being welded to the stiffeners.

Next, the blocks of 85% Magnesia are applied at right angles to the rods. They are held in place with black annealed wire laced around the rod and the block. 1" galvanized poultry netting is then stretched over the insulation and tied tightly to each intersection of lacing wire.

A rough coat of cement is then applied, thick enough to cover the wire mesh. This is followed with a finish coat of cement troweled smooth.

An 8-ounce canvas jacket, neatly pasted on, completes the job. If an expansion joint is used, it should be insulated separately, in the same manner as the duct.

Helping you find the right answers to your insulating problems is only a part of Armstrong's Insulating Service. We can take over the entire job for you—furnish top-quality materials plus skilled mechanics to apply them properly—and eliminate the costly failures that so often result from lack of knowledge or poor workmanship. Next time you're faced with any insulation problem, contact your near-by Armstrong representative. He will be glad to show you how you can take full advantage of Armstrong's *complete* insulation service — and be *sure* of a thoroughly professional job.

SEND US YOUR QUESTIONS: If you have any questions on insulating materials or their use in high- or low-temperature installations, please write us. We'll see that you get a prompt, practical answer. Just address your letter or post card to Armstrong Cork Company, 7003 Maple Street, Lancaster, Pennsylvania.

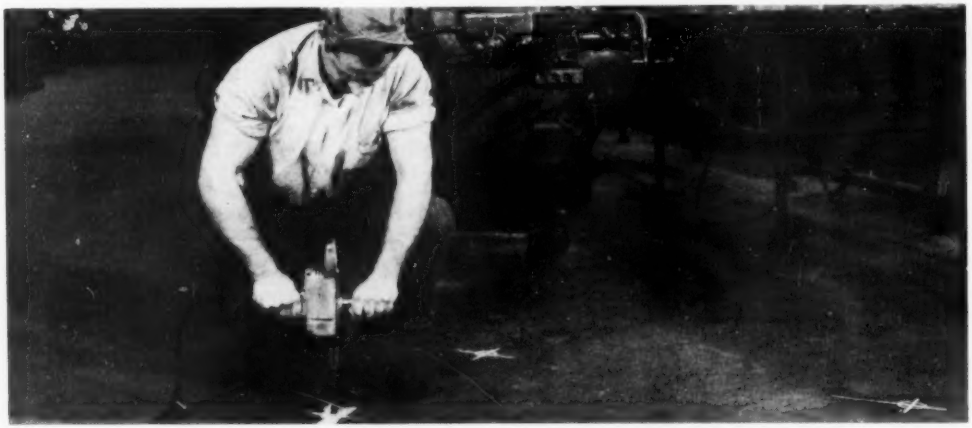
ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

HOW TO DRILL HOLES IN CONCRETE

1 Punching holes in concrete once called for a few basic tools like a machinist's hammer, a star drill, some costly man-hours in labor. But this mechanic calmly lays out the locations for holes, then quietly plugs in his electric drill



2 Drill with a Carboloy tip and spiral is held vertically above spot, and drill started. Hole does not clog and jam drill with dust because spiral lifts it from hole. Operator need not stop to clean hole, but finishes in one operation

3 Lead anchor fits hole made by drill. It's tapped in and ready for the bolt

DUST IS LIFTED BY DRILL

► THERE ARE many ways to make holes in concrete. Old method was to hammer away on a star drill. By turning this drill after each blow, and removing the dust, the job was eventually done. But labor costs too much today.

Another method uses an air hammer to drive the star drill. But that's usually not practical in power plants where only a few holes are needed to anchor a pump or some of the other equipment.

More modern way is to use a hard-tipped rotating drill, such as the Carboloy drill shown here. This has a spiral to lift the dust from the hole. That makes it unnecessary to remove drill until the hole is right depth. Without this spiral, the tightly packed dust often stalled drilling action. Drills are made to fit lead anchors for anchor bolts which are driven in hole with a hammer.

Photos, courtesy of Carboloy Co, Inc

A COMPLETELY NEW 44-PAGE EDITION

Now off the Press!

An Authoritative Guide to Good Trapping Practice

THE *new* Armstrong Steam Trap Book (Catalog J) is a practical working manual for any man concerned with the efficient operation of steam equipment through the correct selection, installation or maintenance of steam traps.

New Trap Catalog Section — complete data on Armstrong cast semi-steel and forged steel inverted bucket traps, compound traps and ball float traps, including: list prices, dimensions, capacities, service pressure ratings and materials.

New Handbook Section — tells how to select the right size trap for nearly every type and size of equipment; including steam mains, purifiers, separators, unit heaters, jacketed kettles, retorts, hot water heaters, coils and syphon drained cylinders; explains how to use the new Armstrong trap capacity chart; explains and gives recommended safety factors; includes reference tables and charts on such subjects as warming-up and radiation loads, condensing rates, recommended trap sizes, Armstrong trap EDR ratings, effect of scale on submerged coil condensing rates.

New Installation and Maintenance Section — covers trap hookups, use of check valves, preventive maintenance schedules, troubleshooting, many practical suggestions and answers to common problems.

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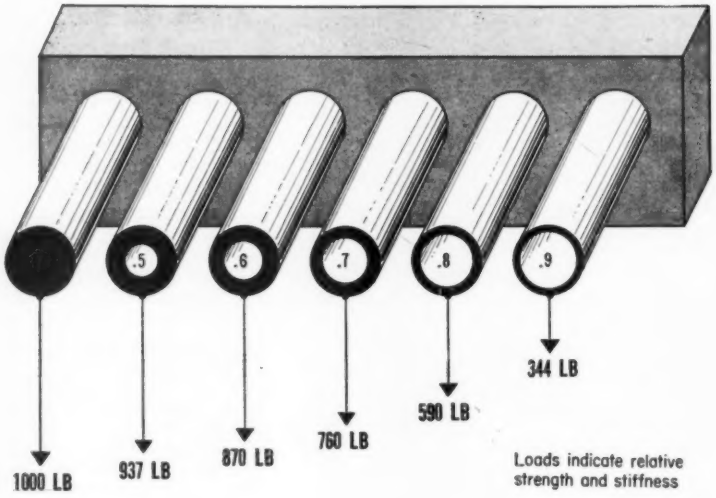
HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Rod Is Stronger Than Tube

► SOME OF THE OLD-TIMERS may question this, but it's a fact. In my early shop days and since, I've often run into mechanics and engineers who claim that a tube is stronger than a solid rod or shaft. It isn't true. Whether you bend it or twist it, the solid rod is both stronger and stiffer than a tube of the same material and of the same outside diameter.

Come to think of it, does it make sense that a shaft would grow stronger if you drilled a core from the center?

To pin down the argument, I looked up the standard formulas and figured out just how strong a tube is (in bending) compared with a solid rod of the same outside diameter. The sketch shows what happens when you drill out the solid rod to various hole diameters. Hole size is shown as decimal fractions of the outside diameter.

All the pieces are shown as cantilever beams projecting the same distance from a wall. If the material and outside diameter is such that 1000 lb is the safe load at the end of the solid rod, then the safe load for the tubes is as shown in sketch.

The thick tube at left (hole equals half outside diameter) shows up fairly well, only 6.3% less than the solid rod. But the loss of strength becomes serious as the walls are thinned down. By the time the inside diameter is up to nine-tenths of the outside, the strength is down 65.6% to a load of 344 lb. This last is only one-third as strong as rod.

Now it so happens that stiffness holds in the same proportion as strength (for tubes of the same outside diameter only). So the tube with the 0.5 hole is 93.7% as stiff as the rod, and the 0.9 hole tube 34.4% as stiff.

To express stiffness another way, all the beams will show the same deflection (depression at the ends) if loaded as shown in sketch.

For shafts under torsion the formulas are different, but here also the solid rod is stronger and stiffer *for the same outside diameter.*

If this is so, somebody will ask, why do we use tubes so often for beams, ships' shafts, machine parts, etc? The answer is already on your tongue. *For a given weight of metal* the tube is much stronger and much stiffer than a solid rod.

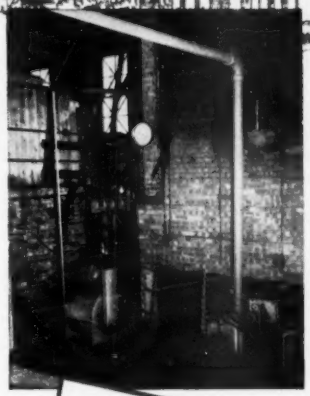
For illustration I have figured out what would happen if you took the metal in a one-inch rod and made it into a two-inch (OD) tube. The tube walls would be 0.134 thick. In bending, this tube figures 3.5 times as strong as the rod and 7 times as stiff.

"We 'educated' our College Heating Plant...

with a modern coal installation we saved more than a third of our fuel bill,"

says Mr. James Gribbon, Chief Engineer of Bethany College, Bethany, West Virginia.

"Colleges watch operating costs as closely as any business firm—and one big item for our college is the heating bill. That's exactly why Bethany went to the expense of putting in new coal heating equipment! Our old system supplied heat for sixteen buildings—to the tune of 2,600 tons of coal a year. Our new installation, with its automatic stoker, does the same job using only 1,650 tons. That's a fuel saving of 38.9%! Our eyes certainly have been opened to the efficiency and economy of *bituminous* coal—especially when it's burned with modern equipment."



Here's Bethany's new boiler room, showing the pipe of the automatic stoker. **THIS MODERN EQUIPMENT WILL PAY FOR ITSELF, THROUGH FUEL SAVINGS ALONE, IN LESS THAN TWO YEARS!**

Modern combustion installations can add anywhere from 10% to 40% to the energy obtained from the same amount of coal in years gone by. Great advances have been made in coal- and ash-handling equipment, too—cutting labor costs—making coal as clean and convenient to use as any fuel.

If you're planning to modernize your present installation—or thinking of building a new plant, call in a competent consulting engineer. He'll show you how a modern coal system designed to meet your specific needs can save you money and serve you better!

And don't forget—you'll always be able to get the coal you need. America's coal industry is the most efficient in the world. America's coal reserves are ample for centuries to come. Right now and for the future, too, coal users can be assured of a dependable fuel supply at reasonable prices.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Washington, D. C.

If you're running your own steam plant—for heat or for power—you just can't afford to ignore these facts!

COAL in most places is today's most economical fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY — FOR LOW COST

YOU CAN COUNT ON COAL!

"Uncle Rumsey bored holes into the firewood . . ."

A Mississippi Hotfoot

► "OUT FOR LUNCH" read the sign on Marmaduke Surfaceblow's dingy office door, above O'Houlihan's Machine Shop and Engine Works, when I dropped by at 2 pm today. There was only one place the old engineer could be—at the Bent Propeller Bar down the street.

I hadn't been around the BPB for months, but the usual crowd of waterfront characters was there. And the place was packed with engineers from merchant ships and from nearby building plants.

And there, standing at one end of the crowded bar, was our own Marmaduke Surfaceblow, engineer extraordinary—and, of late, consulting engineer, if you please. His six-foot four-inch frame towered above the crowd like a deep-sea freighter above tug boats.

Marmy was staring silently at the bottle of Sandpaper Gin before him, seemingly oblivious to the noisy chatter, clanking glasses and horselaughter about him. Yep, this was the old steam engineer, all right. No doubt his mind was grappling with some highly technical problem of trying to up efficiency for a client. Or was he merely cooking up a scheme to get more ballast into his doublebottoms—at no extra cost?

"*Bilgewater on pushbutton operators,*" yelled Marmaduke suddenly, slamming his empty bottle on the bar. The result was immediate and complete. Silence followed instantly.

"What's all the shootin?" croaked a husky longshoreman in a bullfrog voice. He was evidently a newcomer, but his question was soon answered.

"You jokers call yourselves engineers," roared Marmaduke, leaning back against the bar, swinging his running lights from port to starboard about the room. "But there isn't one of you who could have taken a Mississippi River boat down to New Orleans and back 75 years ago. That took engineering—and guts. It was the sweated blood of those early steamboat engineers that allows you guys to sit on your fannies and push buttons."

Marmy stared belligerently at his audience, but none of us let out a peep. Satisfied he was kingpin, he blasted away. "Back in the early Eighties, my uncle, Rumsey Surfaceblow, took me for a ride down to New Orleans on the *Great Republic*. That boat was tops on the river in those days and he was her chief engineer. I was only a kid, but big enough to take care of myself.

"My uncle started steamboating back in 1840 on the old *Grand Turk*. In those days many engineers wanted to be known as a 'hot engineer.' To get that reputation, you had to push a steamboat for all she was worth. Those tough operators didn't know anything about safety or the tensile strength of iron. They only wanted to get all the speed possible without too many accidents.

"Licenses were unknown. And the captain often encouraged unsafe practices. Without knowing anything about machinery, he'd order heavier firing and keeping water low in boilers for making steam faster. Or he would order weighing down the lever safety valve. Unless the chief did these things, many captains wouldn't carry him.

"Boilers exploded so often that one line towed its passengers safely on a barge a hundred feet astern of the boat. To get more speed, another line experimented with copper boilers. Not to be outdone, a competitor painted his boilers with copper paint and advertised 'safe copper boilers.'

"To get more speed during steamboat races, safety valves were tied down and furnaces were fed with resin, turpentine, lard, or any other fast-burning stuff. That didn't help the boilers.

"Boilers were poorly made and Un-

(*Continued on page 210*)

Nalco ARTICLES BULLETINS • REPRINTS Available to You!

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41. Recent Advances in Smoke and Soot Elimination in Coal and Oil Burning Equipment and Diesel Engines
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43. Bul. 46—Nalco Combustion Catalysts SR-150 Soot Remover—SR-155 Fuel Oil Additive
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MISCELLANEOUS WATER TREATMENT DATA

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52. Pioneers in Feedwater Treatment
53. Polyphosphate Stabilization of City Waters
54. Studies on the Cracking of Boiler Plate
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58. Bul. 49—The Nalco System of Water Treatment for Modern Steam Generators
59. Bul. 51—Nalco Products
60. Bul. 52—Nalco Cuprose for Algae Control
61. Bul. 56—Catalog of Water Testing Equipment
62. Bul. 61—Metallographic Examination of Boiler Steel
63. Bul. 63—The Nalco System for Treatment of Low Hardness Boiler Feedwater

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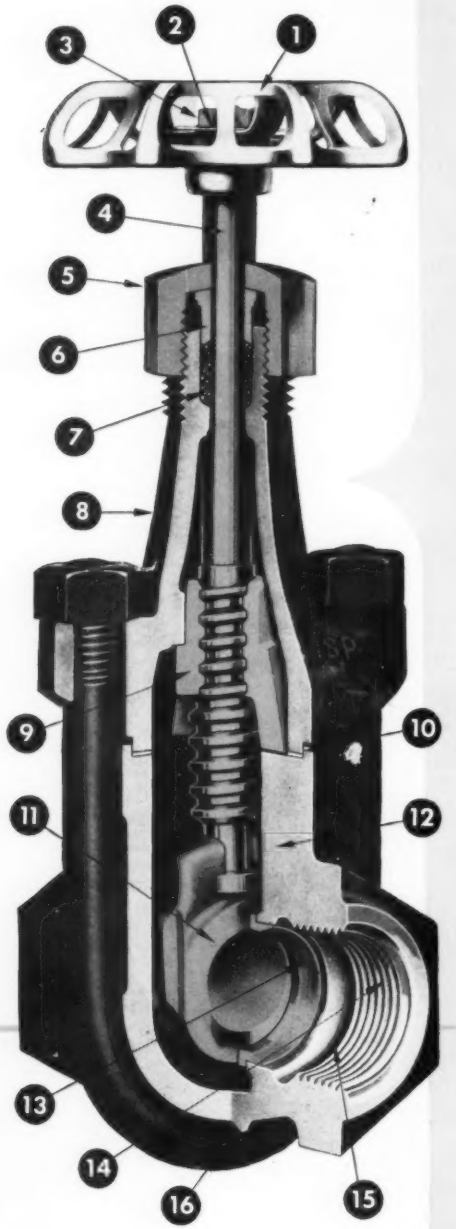
From U-Bolt to bonnet...



1 Perfect-Grip Handwheel
2 Valve Index Plate
3 Secure Wheel Nut
4 Heavy Manganese Bronze Spindle
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6 Self-centering Packing Gland
7 Deep Stuffing Box
8 Heavy Duty Bonnet
9 Unique Renewable Bonnet-Saver Bushing
10 Body-Bonnet Safety Joint
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12 Heavy Duty Body
13 Bronze Seat Rings, Expanded in
14 Full Length Pipe Threads
15 Liberal Diaphragm Clearance
16 Strong U-Bolt

JENKINS
U-Bolt Gate Valves

Fig. 42-A, Bronze Mounted Fig. 40-A, All Iron
Screwed: 150 lbs. Steam — 225 lbs. O.W.G. ¼" to 3"

Fig. 43-A, Bronze Mounted Fig. 41-A, All Iron
Flanged: 125 lbs. Steam — 175 lbs. O.W.G. 1½" to 3"

it has SAVINGS written on it

Only Jenkins U-BOLT GATES measure up to this 16-point standard

TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-Bolt valve. No other valve in its class measures up to Jenkins U-Bolt Gate on all these points, many of them exclusive.

You can take it apart and put it together again in two minutes, and it's a cinch to clean. When operating threads become worn, just slip in a new "Bonnet Saver Bushing" and restore it to new-valve efficiency. It's a favorite for those plumbing-heating, mine, mill or any services where excessive sediment is tough on valves and where freezing is a hazard. You can get it bronze-mounted or all-iron, screwed or flanged.

For "renewability" without waste, bull-necked endurance, and low upkeep cost, you can't beat Jenkins U-Bolt Valves. Yet they cost no more! Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.

BONNET-SAVER BUSHING— enables you to renew the bushing instead of junking the bonnet. Just slip in a new "Bonnet-Saver Bushing" and spindle threads have a new full bearing in the same old bonnet.

EASY TO CLEAN— You can really get into the bonnet of this valve to clean out the chamber above the operating threads, to remove wear-accelerating sediment.

RUGGED CONSTRUCTION— Here's proof. When the U-Bolt nut was tightened down with a 14" socket wrench until the high tensile steel bolt broke, the heavy duty body and bonnet did not crack!

Get this Jenkins U-Bolt Gate Valve circular. Form 179 B. It gives full details of construction and maintenance, lists dimensions. Ask your Jenkins Distributor, or write Jenkins Bros., 100 Park Ave.; New York 17

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

"Scheduling" will get more play in all parts of the defense program from now on. For example, it was one of recommendations of the Morehouse committee surveying the electric power program. They foresee surpluses in some areas, deficiencies in others, if present schedules hold. They believe realignment of manufacturing and construction schedules, by Defense Electric Power Administration and National Production Authority, can bring situation into balance, avoid curtailments.

Little can be done, they say, about 1952 units except to keep strategic ones from slipping. And for most of 1953, best chance is to speed essential units at expense of less essential. But for machines due to come on the line after October of next year, a fresh look can be taken to rearrange schedules to bring regional needs and supplies into balance.

More steel for freight cars may be allocated in 3rd quarter. If this comes to pass, and some of it goes to gondolas and hopper cars, it'll help the coal picture, where car shortages appear to be the only bottleneck.

New components program aims at keeping valves, motors, bearings and similar vital items flowing into key mobilization programs. National Production Authority plans to use directives and spot scheduling, plus increased allotments to components makers. Special expediting units in NPA's industry divisions have responsibility for processing requests from defense industries for components, issuing directives, rescheduling orders where needed. If necessary, NPA may undertake complete production and delivery scheduling of components in some areas.

New defense-order lists, handy for reference, appeared in recent issues of Defense Production Record. Jan 24 issue listed administrators of NPA M-orders, NPA and CMP regulations; Jan 17 listed allotment, DO numbers and symbols. Defense Production Record may be obtained from Supt of Documents, Government Printing Office, Washington 25. Single copies 5¢; $2.50 per year.

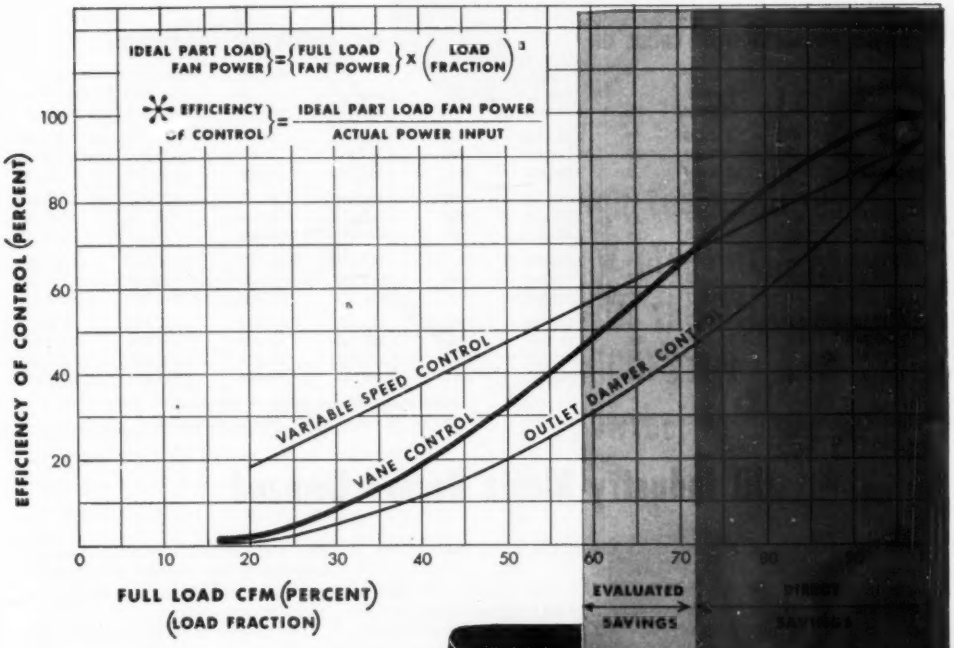
Metal supplies gained as result of accords between U. S., Great Britain and Canada. Churchill meeting traded 1,108,000 tons of steel, scrap and pig iron for 15,000 tons of aluminum and 20,000 long tons of badly needed tin. Canada will make available for export to us 15,800 tons of copper and copper products and 31,700 tons of zinc and zinc products, over and above 1951 exports.

Delayed delivery of controlled materials for construction now gets same treatment as those for production. Amended Section 20 (f) of CMP Reg 1 permits users to charge deliveries of steel, copper and aluminum to their allotments for the quarter in which delivery was promised instead of later quarter when actually received.

Plans for upping oil output have been submitted to Defense Production Authority by Petroleum Administration for Defense. Aimed at meeting predicted demand increases and getting some "cushion" for emergencies, worldwide program calls for over 90,000 new wells by end of 1953, 823,000 bbl daily increase in refining capacity, 23,500 miles of pipelines. What DPA will do when it sees the bill of materials remains to be seen.

FOR PART LOADS

USE STURTEVANT VANE CONTROL® FOR HIGH EFFICIENCY AT LOW COST



If you operate in this range—and most plants do—VANE CONTROL is the economical choice

Have you ever considered the relative efficiencies of methods of mechanical draft fan volume control—and then evaluated them against first cost? Do so, and you will find Sturtevant Inlet VANE CONTROL is the best. It is high in *efficiency of control** and low in first cost.

Whether for forced or induced draft, the *new* VANE CONTROL is a simple and reliable regulator of fan output—a control which responds instantly to varied demands, and yields major power savings at reduced loads.

A new Bulletin, DB 92-810, describes the mechanical improvements developed for Sturtevant VANE CONTROL and its use in mechanical draft, industrial and ventilating applications. Write today for a free copy. Westinghouse Electric Corp., Sturtevant Division, 137 Damon St., Hyde Park, Boston 36, Mass.

YOU CAN BE SURE... IF IT'S **Westinghouse**

PUTTING *Air* TO WORK

J-80220

READER SERVICE SECTION

POWER NEWS 148
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WORLD PRODUCTION OF CRUDE OIL

Year	U.S.A. (000 bbl)	%	Rest of world (000 bbl)	%	Total world (000 bbl)
1939	1,264,962	61	821,198	39	2,086,160
1940	1,353,214	63	796,607	37	2,149,821
1941	1,402,228	63	818,429	37	2,220,657
1942	1,386,645	66	706,455	34	2,093,100
1943	1,505,613	67	751,012	33	2,256,625
1944	1,677,904	65	914,610	35	2,592,514
1945	1,713,655	66	881,304	34	2,594,959
1946	1,733,939	63	1,011,728	37	2,745,667
1947	1,856,987	61	1,164,681	39	3,021,668
1948	2,020,185	59	1,409,001	41	3,429,186
1949	1,841,940	54	1,557,384	46	3,397,691
1950	1,971,845	52	1,825,346	48	3,796,191
1951[1]	2,245,000	56	1,737,500	44	3,986,500

[1] Estimated
Authority: Bureau of Mines; American Petroleum Institute

U.S. PETROLEUM PRODUCTION

Year	Crude oil (000 bbl)	Nat gas (liquids[1]) (000 bbl)	Tot. liq petroleum (000 bbl)	Nat gas (000,000 cu ft gross)
1939	1,264,962	54,148	1,319,110	3,333,500
1940	1,353,214	58,867	1,412,081	3,694,100
1941	1,402,228	84,290	1,486,518	4,103,500
1942	1,386,645	85,719	1,472,364	4,453,900
1943	1,505,613	90,116	1,595,729	5,160,560
1944	1,677,904	102,446	1,780,350	5,614,220
1945	1,713,655	114,884	1,828,539	5,902,180
1946	1,733,939	117,809	1,851,748	6,190,200
1947	1,856,987	132,863	1,989,850	6,733,230
1948	2,020,185	147,079	2,167,264	7,178,777
1949	1,841,940	157,275	1,999,215	7,546,825
1950	1,971,845	181,716	2,153,561	8,479,650
1951[2]	2,245,000	204,000	2,449,000	9,800,000

[1] Natural gasoline and benzol. [2] Estimated
Authority: Bureau of Mines; American Gas Assn

Oil Industry Meets Record Demand

► IN 1951 U.S. PETROLEUM industry met the greatest demand in history with the greatest output of all time. Behind this record stands a string of top performances and a tremendous capital investment.

The 1951 expenditures, estimated at about $3 billion, topped 1950's outlay by nearly 22%. The industry total for expenditures since the end of World War II now approaches $15 billion.

Chief factors behind this tremendous growth, according to Frank M Porter, president of the American Petroleum Institute are: (1) the nation's stepped up mobilization and defense program (2) greater domestic use of petroleum products by homeowners, industrials, all others (3) shutdown of Iranian oil fields and immobilization of the refinery at Abadan.

The U.S. with roughly one-third of the world's oil resources accounted for 56% of the globe's total production, table above. This production, up 4% over last year, reversed a trend in which the U.S. percentage of world production had been dropping steadily in recent years as other countries boosted their output. Further, U.S. oil exports, declining since 1944 jumped to 156 million bbls for the year, an increase of 45 million bbls.

On the domestic front, consumption of the top grade fuel oils increased, in a large measure due to continuing dieselization of the nation's railroads. During the first nine months of 1951 all but 16 of the 1865 new locomotives put into service were diesels. At the end of September almost 99% of locomotives on order were diesels.

The number of home oil burners also went up again in 1951. They now total more than 5,700,000. A large market that can substitute no other fuel.

To keep ahead of this growing domestic load the petroleum industry put down 44,500 new wells, 1200 more than 1950's former record. But 16,000 of these wells proved to be dry holes.

No report is available yet on amount of oil discovered in 1951 but according to API proved reserves were increased as a result of the well-drilling operations. At the beginning of 1951 proved reserves amounted to 29½ billion bbls.

For Coming Events turn to page 190

Hydro Booms in Canada

According to the Dept of Resources and Development, Ottawa, Canada hydroelectric construction in that country continued at a high level during 1951, with 881,250 hp of new capacity going into operation. Allowing for dismantling several old plants of 118,000 hp rating, total installed capacity of water wheels is now 14,340,774 hp. This is nearly 1 hp per capita compared to 0.2 hp in the U.S.

New plants and extensions to existing ones under construction for operation in 1952-53 total more than 1,700,000 hp. About the same amount is under preliminary construction or definitely planned for operation in 1954-55. Power production in 1951 was about 13% higher than in 1950, or 56-billion kwhr. a per capita use of 4000 kwhr compared to 2400 from central stations in the U.S.

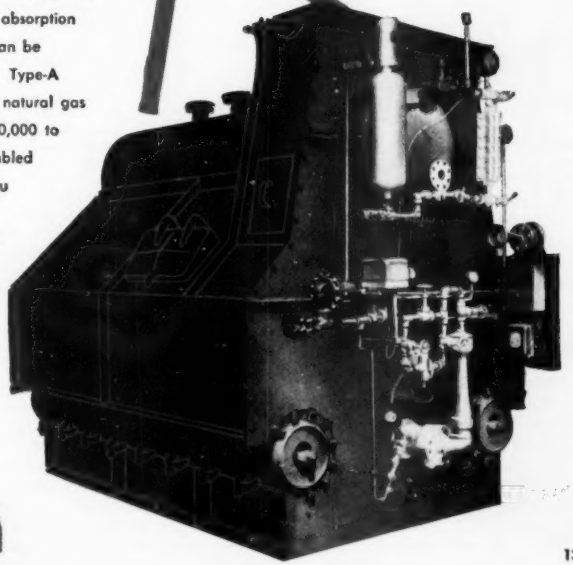
The largest single addition to plant capacity in Canada was 220,000 hp in four units in the Beauharnois plant of the Quebec Hydro-Electric Commission on the St. Lawrence River. Present installed capacity of this plant is about 1,100,000 hp and six units are on order to raise this to over 1,400,000 hp by the end of 1953.

Among the outstanding units being installed is the 82,000-hp impulse wheel to operate under a 2000-ft head in the Wahleach (Jones) Lake development of the British Columbia Electric Co. Another high-head plant now building is that of the Aluminum Co of Canada, on the Kemano River, British Columbia, where 150,000-hp impulse wheels will operate under 2500-ft head in an underground plant. (See p 192).

(*More Power News on page* 190)

high temperatures low pressures with the efficient WICKES type-A dowtherm vaporizer

Wickes Type-A Dowtherm Vaporizer is a compact, efficient radiant heating furnace especially designed for the use of Dowtherm. It is enclosed on both sides by two banks of short, steeply inclined connection tubes that permit operation at maximum temperatures and unusually low pressures without overheating or excessive absorption anywhere in the unit. High temperatures can be accurately and safely controlled. Wickes Type-A Dowtherm Vaporizers, adaptable to oil or natural gas firing, are available in capacities from 750,000 to 20,000,000 B. t. u. per hour—in shop-assembled units up to 6,000,000 B.t.u. per hour. If you are manufacturing petroleum, plastics, paint, food or chemicals or engaged in processing requiring high temperatures, it will pay you to install a Wickes Type-A Dowtherm Vaporizer. Write for descriptive literature or consult your nearest Wickes representative.



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TECHNICAL BRIEFS

Latest engineering developments for busy power men

9 Digests on
FUELS AND FIRING
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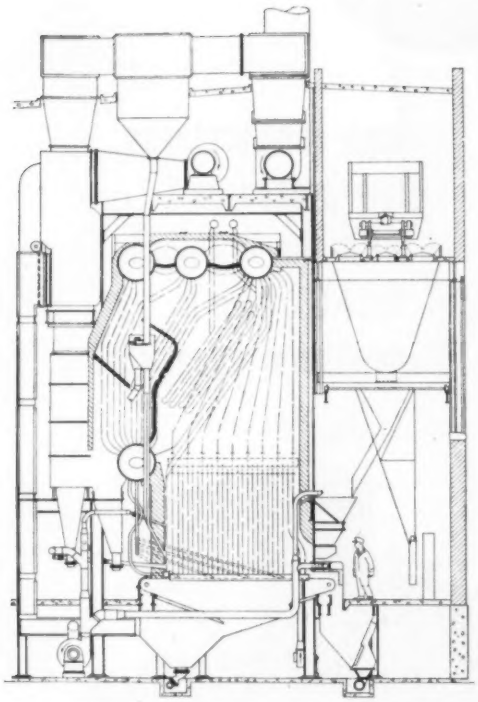


FLYASH RETURNS by gravity from dust collector to furnace area of large, 100,000 lb per hr sp eader-stoker unit above

TEST RESULTS OF FLYASH RETURN SYSTEM

Operating Rates:	*Run 1*	*Run 2*	*Run 3*	*Run 4*	*Run 5*	*Run 6*
Steam lb per hr	83,000	83,400	82,800	82,400	81,400	81,800
Coal lb per hr	8,140	7,940	7,623	7,600	9,920	9,700
Burning rate lb per sq ft per hr	48.0	46.8	45.0	44.8	58.5	57.2
Heat release Btu per cu ft per hr	28,000	27,300	26,200	26,100	27,800	27,300
Heat release Btu per sq ft per hr	636,000	619,000	595,000	591,000	631,000	619,000
Evaporation lb steam per lb coal	10.2	10.5	10.9	10.8	8.2	8.4
Steam, Stack Gas, Air Conditions and Rates:						
Pressure, psig, av Boiler drum	448	451	449	442	446	447
Suphtr outlet	434	435	432	430	432	430
Temp, av, deg F suphtd steam	708	703	712	717	716	716
Air to air heater	133	132	129	131	136	128
Air from heater	292	293	291	301	238	295
Gas to econ	649	655	652	667	654	672
Gas to heater	357	360	358	365	363	371
Gas from heater	265	265	265	273	304	269
Feedwtr to econ	228	228	230	232	230	228
Flue gas temp, av stack	255	254	255	263	308	308
Excess air, blr outlet % (by meter)	16	18	17	21	19	18
Excess air, htr outlet (blr outlet + 5%)	21	23	22	26	24	23
Pressures, av, in. wg						
Air heater inlet	3.2	3.4	3.2	3.6	4.5	3.8
Air heater outlet	1.8	1.9	1.9	2.1	1.8	1.7
Undergrate	1.4	1.4	1.4	1.5	1.4	1.3
Av drafts, in. wg						
Furnace	0.15	0.15	0.15	0.13	0.12	0.13
Blr outlet	0.7	0.7	0.7	0.7	0.8	0.7
Econ outlet	2.7	2.8	2.7	3.0	3.2	2.9
Air heater outlet	3.6	3.6	3.5	3.8	4.1	3.8
Dust col outlet	5.5	5.3	5.2	5.7	6.2	5.9

NOTE: Temperature difference across air side of air heater (63 to 78 F higher than across flue-gas side) must be attributed to different weights of gas on each side or to inaccurate temperature measurements.

Fuels and Firing

Gravity Reinjection of Fly Ash on a Spreader-Stoker. *By Cole H Morrow, J I Case Co; W C Holton, Battelle Memorial Institute, H L Wagner, Detroit Stoker Co.*

In November, 1949 a new 100,000 lb per hr boiler unit, shown above, was put into operation at J I Case Co. It incorporated, so far as known, the first system of gravity return of fly ash from the dust collector to the boiler furnace. W S Major, of Bituminous Coal Research, Inc, called attention to the installation. Detroit Stoker Co, B C R and J I Case Co jointly sponsored a test program to investigate the over-all results obtained with this system. Battelle Memorial Institute supervised and conducted the tests reported here.

Boiler load was maintained at the test rate from two to three hours before each test to bring the entire unit up to normal conditions, at about 83,000 lb per hr. During the test, every effort was made to operate at steady conditions, duplicating actual operation. Toward this end, cinders were collected and reinjected continuously to avoid both "slugging" the furnace with abnormal quantities of cinder and possible accumulation of cinder in the hoppers. All but one test ran four hours.

The weight of coal fired was determined by filling the stoker hopper to the same level before and after the test and weighing the coal added. Refuse was removed from the undergrate hoppers before and after the test. Dust-emission determinations at the stack were run for three hours, except in the one case above.

Table above presents some of the significant observed and calculated results. The small difference between the temperature of air to the air heater and the flue gas from the air heater is of special interest, since this contributes materially to the high efficiency of the unit.

The low values of excess air reported in this table should also be noted. These data were obtained by integrating the recording chart on the excess air meter which analyzed gas from the boiler outlet. *ASME Paper, No Number.*

(Continued on page 152)

How to make packings last longer

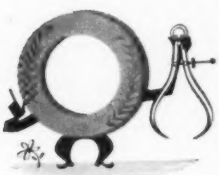
Tips by Johns-Manville Engineers to help you keep production rolling

Correct installation cures many packing troubles

Danger! Don't mix me with old packings

Old packings may look all right, but often they are so dry and highly compressed that they may cause scoring. Play it safe and remove *all* old packing before putting new packing in place. Be sure to remove accumulations from stuffing box walls, gland follower and shaft. New packing is cheaper than new rods, shafts and sleeves!

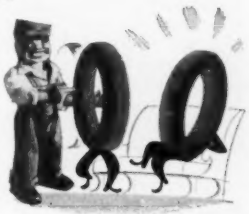
Make sure I'm the right size



Packing that's too small may turn with the shaft. Oversize packing may cause excessive pressure and subsequent scoring. To find the correct size, check the rod or shaft diameter and the inside diameter of the stuffing box—then choose a packing to fit. In this way, allowance is automatically made for wear of the rod.

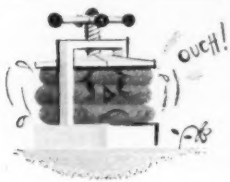
Seat me one ring at a time

Never load the stuffing box with packing rings and try to seat them all at once by tightening the gland follower. This invites trouble due to excessive gland pressure. Always install one ring at a time, making sure it's properly seated *before* the next ring is installed.



Don't squeeze me too tight!

Too much gland pressure is a common cause of packing failures. After the packing is installed, pull up the follower only sufficiently tight to insure seating of the last rings installed. Then back it off, leaving the nuts finger-tight. Don't worry about a little leakage. Actually, it's good assurance that the packing isn't too tight in the stuffing box. Besides, the liquid frequently has some lubricating qualities.



Why you can expect longer life from

NAVALON Style No. 190

Made from specially processed ramie—nature's strongest fiber—Navalon stands up in severe service where other cold-liquid packings fail. It gives outstanding performance in pumps, elevators, accumulators, presses, and on reciprocating rods and plungers operating against fresh or salt water, brine, cold oil and many other liquids.

Your distributor will help, too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

More TECHNICAL BRIEFS

Begins on page 150

Air Pollution and the Mechanical Engineer. *By F G Sawyer, Stanford Research Institute.*

Air pollution may be considered a problem of public relations, engineering, good housekeeping, morals, politics, economics, and whatnot. It all depends on how you look at it. One thing is certain—it affects us all. It costs us money; it causes nuisance; it may damage our health.

The challenge of air pollution lies in its continued growth and increasing complexity. No longer is it enough to cut down smoke and soot in the air over a city. Serious thought must be given to the invisible emissions as well. Study of the Los Angeles atmosphere teaches many lessons that may be important for eastern cities as they shift from coal energy to petroleum and natural gas.

Los Angeles is not a smoky city by eastern standards. Almost no coal is burned so that soot and flyash are not major problems. As in other cities, there are thousands of different emissions of gases, solid particles, and liquid droplets. What makes Los Angeles different is the meteorology and topography that combine to accent the effects of pollutants present. The city lies in a basin confined by mountains on three sides. Seasonal weak winds fail to move the polluted air out. A blanket of warm air, the inversion layer, acts as a lid over the basin for a large part of the year, and when this layer descends to 500-1500 ft, the pollutants are crowded close to the ground and *smog* results.

Perhaps the simplest way to get rid of smog is to get the wastes high enough into the air by means of a stack. The higher the stack, the better will be the distribution of wastes. With hotter gases, lower stack will give equivalent discharge distribution. But in an area prone to temperature inversion the importance of studying the micrometeorology of the region cannot be over-emphasized.

Research, much of it by mechanical engineers, will eventually find the most economical control of industrial air pollutants. This may result in: 1. Improving quality and increasing quantity of products. 2. Returning extra revenue. 3. Cutting plant maintenance costs. 4. Increasing operating efficiency and accelerating production. 5. Cultivating good will of the public. 6. Improving labor relations. 7. Providing safer and more sanitary working conditions, all leading to best co-operation from personnel in keeping the operations clean. 8. Justification for company pride in contributing to industrial progress. *ASME Paper. No. 51-A-76.*

Flow and Combustion Stability. *By N P Bailey, Rensselaer Polytechnic Institute.*

Mechanical engineering interest in combustion before 1925 was primarily concerned with construction of combustion equipment and standardization tests of fuels. Between 1925 and 1940, M. E.'s studied the elementary physical chemistry of hydrocarbon fuels and the thermodynamics of chemical equilibrium. Now gas turbines, turbo-jets, rockets and ram jets need modulated or variable load combustion. Here mechanical engineers must make a unique contribution to the art and science of combustion.

For a combustion system to operate satisfactorily over a wide range of loads and temperatures, all of its elements must be designed in balance and controlled to produce stability. With improper design, balance and control a rough burning or even completely unstable system can result.

This mechanical engineering job requires bringing the correct amounts of fuel and air together under the right conditions and at just the right time. If this is accomplished the chemistry will take care of itself, but if this is not achieved all the chemistry in the world is of no avail.

Surging, pulsation and blowout of semistable and unstable flow and combustion systems have been largely neglected. Noise is the most characteristic thing about recent high velocity and high energy release combustion developments and noise is produced only by unsteady systems.

The author then discusses the principal stability factors. *ASME Paper. No. 51-A-83.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following source unless otherwise stated. Order complete paper from source, not POWER.

American Society of Mechanical Engineers, annual meeting, Nov 26-30, Chalfonte-Haddon Hall, Atlantic City, N. J. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.

Commercial Burner Oil Specifications. *By J Verne Resek, Cleaver-Brooks Co.*

On January 9, 1929, a joint conference of refiners, distributors and consumers of fuel oil, and manufacturers and distributors of oil burners, adopted a recommended standard for domestic and industrial fuel oils. This was published by the Department of Commerce, Bureau of Standards, as Commercial Standard CS 12-29.

In 1933, 1934, 1938 and 1940, revisions were adopted and promulgated by the Bureau of Standards. On September 28, 1948, the latest revision was approved by the Bureau. It was drafted by the American Society for Testing Materials, and is called CS 12-48.

The value of these Standards is discussed from the viewpoint of the refiner, the distributor, the burner manufacturer and the general public; suggestions are made for further revisions to improve them and to protect the interests of the above parties. A further revision of the standard fuel oil specifications is suggested so that the refiner and oil distributor, as well as the burner manufacturer and ultimate burner owner, may know exactly what oil should be used in a particular burner and what results may be expected. The manufacturer should be able to recommend a certain grade of oil for his burner, and the burner owner should be able to buy that grade of oil and feel sure that it will always operate properly. *ASME Paper. No. 51-A-125.*

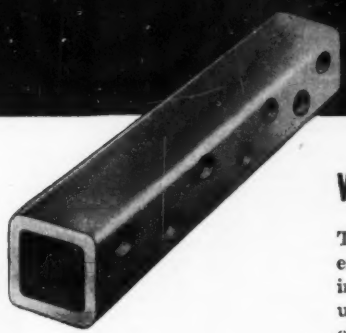
The Design and Application of Waste Heat Boilers. *By Robert Cubberly and K J Ray, Foster Wheeler Corp.*

The economic success of every workable process depends upon efficient use of energy. Engineers must constantly seek and devise ways of using the excess energy that is discharged from every process. The waste heat boiler is sometimes well suited to recover excess energy.

Often, it serves a dual purpose, first as a means of process control, and second, as a means of energy conservation. It may be used to control the temperature of an exothermic reaction to maintain a favorable reaction equilibrium. It may serve as a condenser to remove heat of vaporization and it may be used for rapid cooling of a gas, liquid or a fluidized solid. The waste heat boiler is a heat exchanger serving several special purposes, but with definite limitations.

Two principal factors must be con-

(*Continued on page* 186)



Who put the windows in Bus Conductors?

The "windows" are ventilating holes which Chase engineers put in to aid the dissipation of heat. They increase the current carrying capacity about 20% over unventilated tubes. And a ventilated square tube bus conductor means saving up to 36% in the weight of copper used.

When you add to this high mechanical strength, ease of assembly and erection and resistance to corrosion, you'll agree that Chase square copper tube conductors are ideal. Write Dept. PO 352 for the Chase Bus Conductor Handbook.

Chase BRASS & COPPER

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NEW CRANE

SMALL STEEL VALVES

WITH *REVOLUTIONARY* LIP-SEAL BONNET JOINT

(PATENTED)

1500 AND 2500-POUND CLASSES

Look closely at the Lip-Seal Bonnet joint of this new Crane small steel valve. A small bead of weld metal seals the joint against leakage—yet the entire mechanical load, both pressure and stem thrust, is carried by strong threaded members.

Here is bonnet joint improvement that brings you important benefits beyond tight sealing and freedom from maintenance.

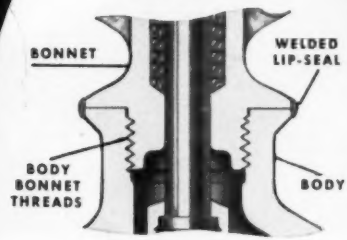
For example, Crane Lip-Seal design permits a weight-saving, compact structure without sacrificing strength or reducing seat area. It combines significant developments for improved flow control, ease of operation, and durability. Add to these the ease with which the Lip-Seal joint may be dismantled and re-assembled—and you have a valve with outstanding suitability for your high-pressure/high-temperature power service needs.

It's not an untried valve. Hundreds are already in service, giving complete satisfaction. They're particularly recommended for use on main steam, auxiliary steam, boiler feed and miscellaneous piping for drips, drains, by-pass, blowdown and similar service.

Simplified Dismantling and Re-assembly

The Lip-Seal joint is quickly dismantled by removing the small seal on the lips and unscrewing. The lips are shaped and positioned to simplify removal by grinding. They're entirely accessible; no pockets or corners to clean out. Re-welding is equally simplified.

THE EXCLUSIVE CRANE LIP-SEAL PRINCIPLE



Body and bonnet have extra long threaded engagement. This provides a firm metal-to-metal contact at the bearing surfaces of the joint. The small lips around the periphery are then seal welded. Bursting pressure and severe quenching tests have proved conclusively that the seal weld does not carry any mechanical load at rated pressures. It merely seals the joint against leakage. Threaded members alone carry the mechanical load—and at comparatively low stresses.

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That's Why More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
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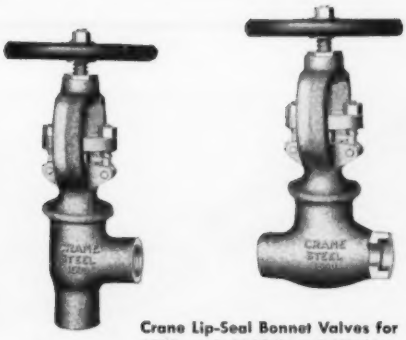
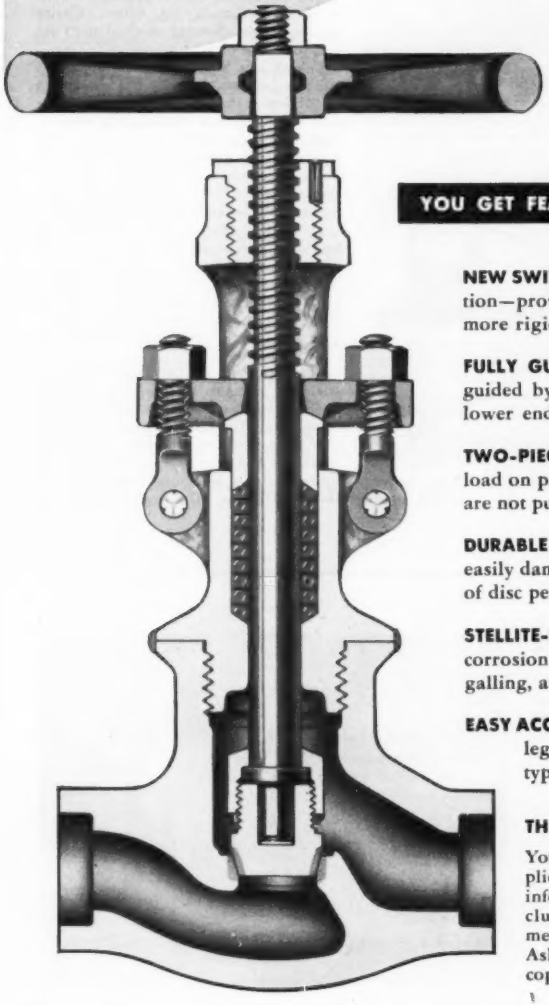
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

DESIGNED AND TESTED TO GIVE YOU:

- Absolute Tightness
- Freedom from Bonnet Joint Maintenance
- Minimum Weight and Bulk
- Easier Dismantling and Re-assembly



Crane Lip-Seal Bonnet Valves for 1500 and 2500-Pound Working Pressures. In Globe and Angle patterns; Socket-welding or Screwed Ends. Sizes: ½ to 2-inch. Choice of Steel as required for service conditions.



YOU GET FEATURES LIKE THESE IN LIP-SEAL VALVES

NEW SWIVEL DISC-STEM CONNECTION—Minimizes vibration—provides long pilot guiding for disc. Design makes a more rigid—yet swivel-free—connection.

FULLY GUIDED STEM—Smoother, easier to operate. Fully guided by long yoke bushing and long engagement with lower end of bonnet. Gives positive, straight-line seating.

TWO-PIECE BALL-TYPE PACKING GLAND—Assures uniform load on packing. Prevents binding on stem even when nuts are not pulled up equally.

DURABLE PLUG-TYPE DISC—Has wide seating contact not easily damaged by foreign matter or by wiredrawing. Taper of disc permits close flow regulation while throttling.

STELLITE-FACED SEATING SURFACES—Effectively withstand corrosion and erosion; highly resistant to wear, seizure, galling, and abrasion. Seat is integral with body.

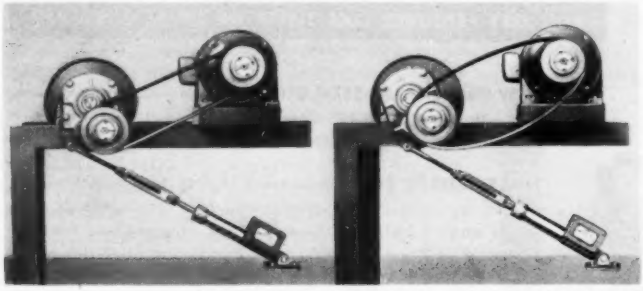
EASY ACCESS TO STUFFING BOX—Ample space within yoke legs allows convenient re-packing. The swinging type gland eye-bolts swing completely clear.

THIS CIRCULAR READY FOR YOU

Your copy of this 8-page booklet supplied free on request. Gives complete information on Lip-Seal Valves, including materials, service recommendations, sizes, and dimensions. Ask your Crane Representative for a copy or write to address at left.

PLANT EQUIPMENT NEWS *Your information . . .*

OVERLOAD RELEASE for *Torque-Arm* speed reducer. New unit prevents breakdowns, replaces the standard torque-arm regularly furnished; the two are interchangeable



SET. Here release is set, belts are tight, speed reducer in operating position

TRIPPED. At overload *Tri-Matic* loosens belts, cuts off power, sets off alarm

OVERLOAD PROTECTION FOR SPEED REDUCER

P323 • Overload release for the Dodge *Torque-Arm* Speed Reducer provides instant and positive protection for driven machines, motors and the speed reducer itself. Designed to prevent breakdowns, and insure against interruptions of production resulting from any excessive load on the equipment.

This device is called the Dodge *Tri-Matic* overload release. It gives triple protection against overloading as outlined above. It does not replace the normal electrical protection to the motor. Circuit breakers, fuses, thermal overload units etc remain in the picture.

Release acts instantly and positively. It operates both mechanically and electrically to (1) loosen the belts (2) cut off the current (3) activate a warning bell, siren or light. Pressure exerted by an excessive load causes a piston to move lengthwise through the unit. This loosens the belts and cuts off current simultaneously. Warning system is hooked up to the micro switch.

Tri-Matic is calibrated for adjustment to load conditions of any job. It can be set to act at any desired load up to the reducer's maximum capacity. To reset the *Tri-Matic* after it has been tripped simply pull the speed reducer back manually into position. This automatically cocks the overload release mechanism.

New unit replaces the standard torque-arm that is regularly furnished with the Dodge Speed Reducer—the two are interchangeable. The *Tri-Matic* will be available from distributors' stocks in sizes for all Dodge *Torque-Arm* Speed Reducers in either single or double reduction series.

Dodge Mfg. Co, Mishawaka, Ind.

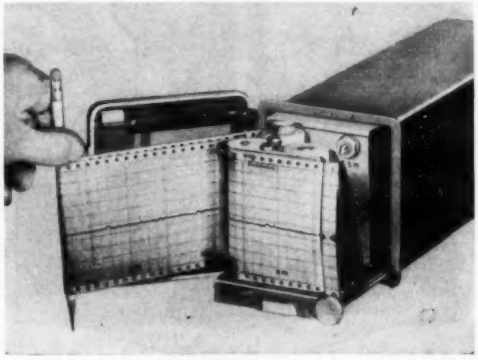
MINIATURE STRIP CHART RECORDER

P325 • Independently powered miniature strip chart recorder plus an electronically actuated pen are features of the *Autronic Recorder*. Suitable for use in chemical and food processing plants, refineries, petrochemical installations, central stations and industrial power plants. It is an electronic servo-powered null-balance device creating a highly accurate and instantaneous record of the measured variable.

Unbalance between output of primary element transmitter and balancing transformer is amplified to drive the rotary-solenoid motor for positioning pen. Pen can cross 3-in. chart in ½ sec.

Autronic Recorder gives a true linear record. Chart passes over right-hand edge of the convex-arc chart plate. The radius of both chart plate and pen arm is 8 in., and pen traces on edge of chart. Three hours of record are visible; standard speed is 1 in. per hr. A 30-day chart is supplied.

Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio



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PACKAGED STEAM GENERATOR FIRED WITH GAS OR OIL

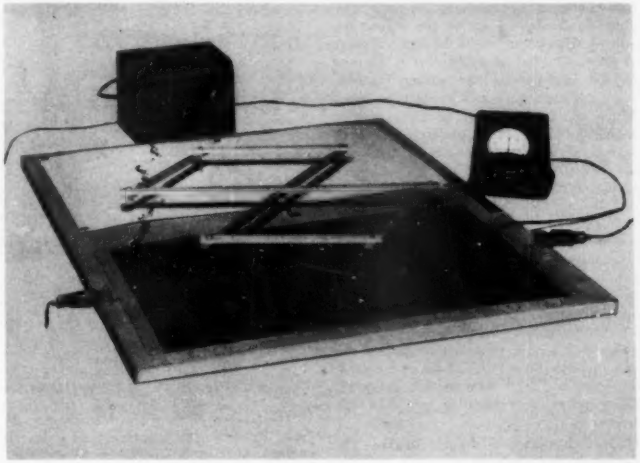
P335 • Fully automatic and self-contained, the *Continental* steam generator is easy to install, efficient, economical to maintain. One of the boiler's important features is that front and back can be opened in 15-20 minutes, providing ready access for interior cleaning and servicing.

Steam generator is ready to operate when service connections are made. It is available for use with heavy oil, light oil, gas or a combination, and in sizes from about 300 to 15,000 lb per hr for 15 to 200 psi. These cover a wide variety of industrial and commercial needs for heating and processing steam.

Continental unit is an improved 2-pass version of the Scotch marine type boiler. Efficiency is guaranteed to be at least 80%, with steam moisture content under 1%. Operation of burner can be modulated from 35 to 125%, providing for periodic oversurge when required.

To assure maximum heat transfer and low flue gas temperature, all fuel is burned in the water-surrounded boiler furnace. Gases pass spirally through large 3-in. tubes. The 2-pass construction eliminates excess refractory, since the only refractory required is at the back of the boiler.

Dry pipe in boiler removes condensate from steam keeping moisture content low. In addition the steam tends to remain dry since a constant water level is maintained automatically. This steam generator is equipped with automatic controls plus rotary firing. The latter feature conditions the fuel and combustion air yielding a uniform fire with high radiant energy.
Boiler Engineering and Supply Co, Phoenixville, Pa.



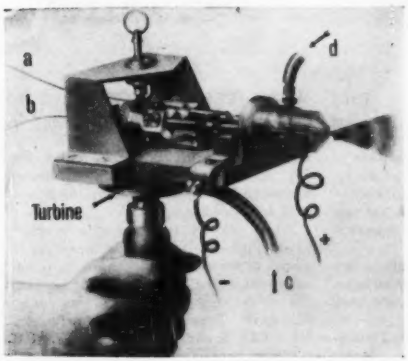
PLOTTER FOR ELECTRICAL FIELDS AND FLUID FLOW

P328 • Portable analog field plotter, a versatile tool for rapid solution of complex two dimensional field problems. Device sets up electrical field patterns in a thin conducting-paper surface on the plotting board. Analogy between the electric field in the paper and the related field problems—such as might exist in electrostatics, electromagnetics, thermal and fluid flow, etc.—allows an easy solution to a broad range of difficult problems.

Plotter can be used to study air flow patterns, electrical fields, fluid flow and temperature distribution. May be used to study fluid flow patterns and velocity gradients in steam and gas turbine blade grid assemblies.

It consists basically of a plotting board and exploratory stylus, 115 volts ac input, a high-accuracy multi-turn voltage divider, sensitive microammeter with specially designed overload protection, and a supply of conducting paper and silver paint.
General Electric Co, Schenectady, N. Y.

For more data on these items, use post cards, p 163



LOW VOLTAGE ELECTRIC-ARC METAL SPRAYING

P324 • Up to 50 pounds of metal per hour can be sprayed with the *Schoop-Pistole* and temperatures up to 4000 C at the melting arc are available, according to *Corrosion* Magazine. This temperature is sufficient to fuse and disperse such hard metals as molybdenum, chromium, tungsten and their alloys and apply them to the desired surfaces. Temperatures of the particles emitted from the arc are so high they will fuse into a glass or quartz surface forming a homogeneous, even metal film impossible to separate physically from the underlying material.

The inventor claims three times more by weight of zinc and aluminum may be deposited than with the gas-fired spray pistol.

In coating iron or steel a nitrated zone is reported at the interface of the body and coating material.

The pistol consists essentially of two electrodes (*a-b* in photo), the necessary electrical connections, + and –, and an air jet, *d*, which blows through the arc created by the electrodes. Wires are fed by action of a 35,000 rpm turbine actuated by the air, through *c*, before impinging on the arc.
(*Continued on page* 158)

More EQUIPMENT NEWS

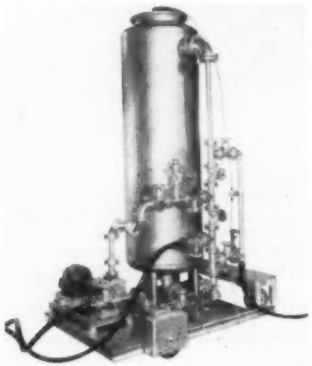
Begins on page 156

Metal Spraying, continued

50 Volts DC. In the electric pistol two wires of small transverse section are fed into contact at the point of the pistol. 50-volts dc is applied across the wires. Resulting short circuit melts the contact metal. A jet of air (four atmospheres) is directed at the arc, driving the molten material away and reducing it to very small particles. When contact is broken an arc is formed in which further fusion takes place. Tests with a rotating mirror show a recurring short-circuit also plays a role in the melting of the electrodes.

Uses. Besides the obvious application of cathodic metals to steel the *Electro-Pistole* has been used to create dies for forming elastomer or ceramic parts by spraying on a pattern. The gun may be used also to spray metals onto textiles, where the metal particles penetrate the material. Result is a product which is pliable, porous to air and which still partakes in large measure the protective characteristics of the metal used. Gun also has been used to coat celluloid, paper and other combustible materials with metals.

M U Schoop, Gladsbach Strasse 11, Zurich 5, Switzerland

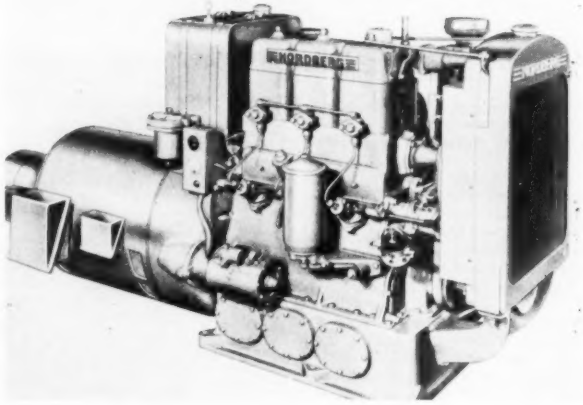


WATER PURIFIER **P329**

A portable version of the chrome purifier for recovering and purifying chromic acid anodizing baths and reclaiming plating and rinse waters. With this unit there's no need to discard chromic acid to maintain a required pH and acid concentration. Contamination of acid solution is kept at a minimum when processed by this method.

Illco-Way chrome purifier is available in four standard sizes. Each size is available in stationary models for permanent installation and portable models for treatment of several solutions located throughout plant.

Illinois Water Treatment Co, 840 Cedar St, Rockford, Ill.

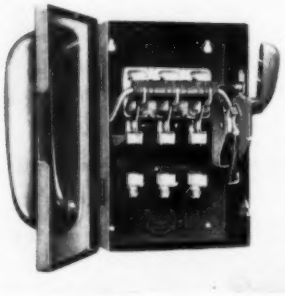


SMALL HEAVY-DUTY DIESELS USE DIRECT OR BELT DRIVE

P318 • Type 4FS3 is a 4½x5¼ in. 4-cycle vertical mechanical-injection 3-cyl engine. Ratings 30 to 45 hp at 1200 to 1800 rpm. Available as a generating set, pumping unit and with clutch or stub-shaft power take-off for direct or belt drive. Unit is delivered ready to connect to load. Generators are ac or dc, 20 to 30 kw at all standard voltages, 50 and 60 cps. Unit may be used for power generation or standby service. Pumping unit handles 500 to 3000 gpm at heads from 20 to 220 ft. Engines are designed for minimum maintenance. Electric starting equipment standard but compression release for hand starting only can also be supplied.

Radiator-type cooling system, diaphragm-type fuel transfer pump, mechanical fly-ball-type governor are a few features.

Nordberg Mfg Co, Milwaukee 1, Wis.

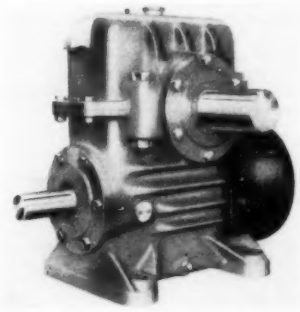


SAFETY SWITCHES **P351**

Complete line of safety switches that meet the recently adopted Federal specifications W-S-865. These switches vary in ratings up to 2400 amp, 600 v and 50 hp. The *Type A* switch has a quick-make, quick-break mechanism. Magnetic arc suppressors give exceptionally high interrupting capacity.

Type C switches are for medium-duty and general service, while *Type D* switches are approved for light-duty service such as lighting loads.

Square D Co, 6060 Rivard St, Detroit 11, Mich.



WORM SPEED REDUCER **P326**

A variety of ratios available ranging from 5 to 1 through 100 to 1 and from fractional up to 400 hp. The smaller units, 1⅛, 1¾ and 2¼ in. dia, feature universal mounting for worm on bottom, top or vertical installation.

While delivery is made with assembly as specified, legs are removable and can be mated to other holes in housing to permit varied mounting. Ten sizes ranging from 3½ in. through 14" in. are all fan cooled.

National Transmission Distributors, Inc., 684 Broadway, New York, N. Y.

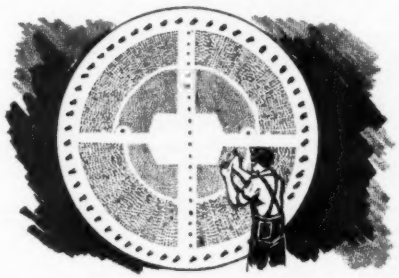
(*More Equipment News on page* 160)

For more data on these items, use post cards, p 163. Identify request with P and number.

BUSINESS IN MOTION

To our Colleagues in American Business . . .

American business lays great emphasis upon salesmanship, and correctly so, because orders keep a company busy, provide employment, meet the payroll, pay for materials, amortize machines and buy new ones, and, if management is skilled, provide profits. Yet there are times when it is best to turn down an order. If, for example, a would-be buyer really doesn't need what he asks for, it is good business to tell him so, and show him a better way to satisfy his need. Revere has done this many times. In a recent instance, we were able to save a prospective customer some $30,000. This was done while working with a public utility, an important user of condenser tubes. Examination of leaking tubes from one of its condensers showed that the trouble was due to a combination of erosion and corrosion at the inlet ends; the tubes were in good condition otherwise.



The condenser contains some 4,100 tubes, and to replace them would cost about $35,000, surely a high price to pay for damage to a few inches at one end of each tube. Revere, instead of taking the order for 4,100 tubes, recommended use of a device to cure the trouble. There are several different makes of such devices, intended to be inserted in the leaky ends, thus effecting a repair. When conditions are suitable, several more years of service may be obtained from the original tubes. In the case under consideration, the cost of the repair was only $5,000.

So successful has this recommendation proved for the utility that it has been followed for a second condenser. This has about 2,700 tubes, and a corresponding saving has been realized. Of course, one might say that if the condensers had been properly designed in the first place, erosion-corrosion at the inlet ends would not have occurred. This is true, but the fact is that many utilities and other companies operating steam condensers have found it necessary to put burdens on them in excess of those for which they were originally designed. This necessitates increasing the velocity of cooling water, which in turn makes erosion more likely. Also, water conditions often change over a period of years, so that more corrosive conditions may build up, particularly in the industrial areas where so many condensers are located.

In showing this customer how to avoid buying a lot of condenser tubes, Revere was motivated by two principles. One was, and is, that fast friends and loyal customers are won by taking to heart the best interests of those with whom we deal. The other is the patriotic motive of making the vital copper alloys serve as long and go as far as possible.

Many other materials besides Revere's Copper and Copper Alloys and Aluminum Alloys are vital to defense in one way or another. We urge everyone to conserve such materials as much as possible. Consult your suppliers. Like Revere they are not in business just for today or tomorrow, but, we all hope, forever. They will know what can be done to lengthen the service to be expected. This is not only patriotic, but it is also good business for them and for you.

REVERE COPPER AND BRASS INCORPORATED

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***Executive Offices:* 230 Park Avenue, New York 17, N.Y.**

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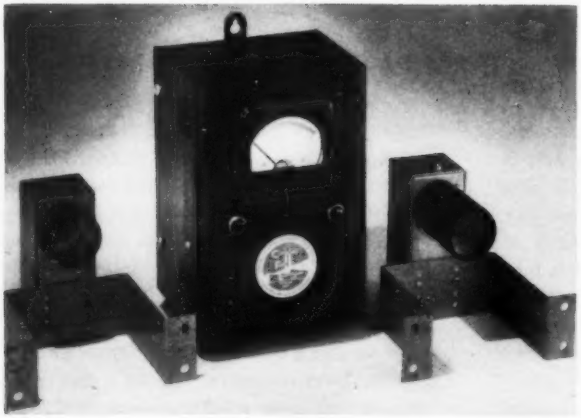
More EQUIPMENT NEWS

Begins on page 156



SMOKE INDICATOR WITH REMOTE MASTER CONTROL

P330 • Photoelectric cell system gives constant check on smoke density. It consists of three units: light source; photoelectric cell whose output is proportional to density of smoke; and a master control with amplifier, relay, smoke density meter calibrated in Rengelmann units.

Light source and photoelectric cell units mount on opposite sides of breeching or smoke chamber, centered over two 2-in. holes in breeching walls. Both light source and photocell unit are spaced from breeching to permit natural air drafts to keep lenses cool and clean.

Master control, which may be located remotely, can be set for a pre-determined smoke density, with no further adjustment required. Indicator responds to any variation in smoke density. Standard units are available for either 110- or 220-v, 60 cycle.

Cleveland Fuel Equipment Co, 7316 Associate Ave, Cleveland 9, Ohio.

CHECK THESE TOO! . . .

Lab Coal Crusher grinds welding flux ..... p 168
Cabinet Heater for steam, hot water p 170
Small Valves high-pressure, temp ... p 172
Process Pump handles up to 1000 gpm ..... p 172
Fluorescent Ballast, cool, quiet ... p 174
Aluminum Tubing for oil, gasoline p 174
Precision Ohmmeter, battery operated ..... p 176
Emergency Light, fully automatic ... p 178

PIPE CEMENT P304

Nerva-Plast is a patented compound of rubber and selected asphaltic hydrocarbons. On drying it forms a tough, resilient, unbreakable elastic film suitable for use on insulated outdoor pipelines and equipment. Cement is cold setting, impervious to water and moisture vapor penetration. Pipe corrosion is prevented by the film. It may be applied to aluminum foil, Fiberglas fabric, Foamglas and 85% magnesia insulation. On some jobs a coat of *Nerva-Plast* applied to outdoor pipe and equipment is enough to provide needed weatherproofing and waterproofing. Or *Nerva-Strat Seal-Prof*, Type-60, a flexible and highly waterproof rubberized sheet is wrapped around the material to be insulated and coated with *Nerva-Plast* cement.

Rubber & Plastics Compound Co, Inc, 30 Rockefeller Plaza, New York 20.

DRAFT REGULATOR P343

Unit is designed to increase gas-fired boiler efficiency, and eliminate many draft-related operating problems of commercial and industrial plants. Close regulation of drafts enables gas-fired boilers to be adjusted for greater operating efficiencies.

When installed on either new or old boilers, in place of the common diverter, the control eliminates many operating difficulties. For example, pulsation troubles have been corrected; boilers fired by atmospheric burners have operated at higher ratings than possible with diverters. Combustion has been improved with both forced draft and atmospheric burners thus allowing quicker pick-ups when steam loads vary rapidly.

Designated as the *Field* type M-G double-acting barometric draft control, the unit mounts on the flue pipe or breeching. It has a sensitive gate which swings inward to provide accurate updraft regulation, and outward to provide immediate relief for down-drafts.

Field Control Div, H D Conkey Co, Mendota, Ill.

TACHOMETER P331

Suitable for turbine overspeed tests, production motor test stands, dynamometer test stands, laboratories, and similar precision speed measuring applications. Accuracy is sustained, even under adverse external conditions, by simple calibration adjustments, mounted on front of instrument.

Ten overlapping and adjoining ranges, selected by rotary switch, provide more than a 10 to 1 spread in speed. Indicating meter has three scales selected for good readability of minor divisions in integral numbers. Speeds of 36 to 100,000 rpm are easily covered by three models.

Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

RUST-PREVENTIVE PAINT P317

Rust Inhibitor No. FD-425 dries in 10 min, one coat providing excellent hiding of old metal surfaces. Paint will withstand temperatures from –100 to + 250 F, resists salt air and fumes. It may be applied to damp surfaces, interior or exterior. Semi-gloss finish; various colors obtainable.

United Laboratories, Inc, Cleveland 12, Ohio

PRESSURE PILOT P322

Available as shown or integrally mounted on a Honeywell diaphragm valve, with or without a pressure-reducing valve, an air filter or a top- or side-mounted positioner. Pressure-reducing valve and air filter can be furnished when a clean supply of air or gas at a constant reduced pressure of 20 psi is not available. Proper connecting piping is furnished to meet any mounting

(*Continued on page* 168)

For more data on these items, use post cards, p 163. Identify request with P and number.

ANSWER:

CONSULT THE MAKER OF ALL TYPES

for an unbiased recommendation

PHILLIE GEAR

When you get a recommendation from Philadelphia for the application of a speed reducer to fit your drive you can be sure it is the *best* type unit you can get for that need. We make *all types and sizes* so our recommendations are not biased through a limited selection but are absolutely impartial.

Thousands of Philadelphia Speed Reducers are transmitting power dependably and economically in all lines of industry and in all parts of the world. As a result, we have gained a thorough understanding of industry's varied drive requirements. That experience has been applied to the design and construction of all our speed reducers and is a fundamental reason for the continuing preference for Philadelphia products.

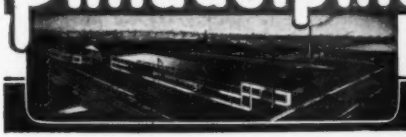
OUR 60TH ANNIVERSARY

Whatever your power transmission problem it will pay you to talk it over with Philadelphia.

Catalogs are available on each type Philadelphia Speed Reducer, GearMotor and MotoReducer. Write on your business letterhead and ask for the one you need.

Shown counterclockwise above—Herringbone, Planetary, Spiral Bevel, Worm Gear Reducers, Speed Increaser, GearMotor, Vertical MotoReducer, Steeple Type Worm Reducer.

Philadelphia Gear Works, INC.



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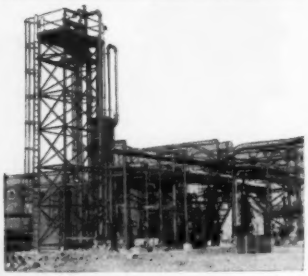
ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

CASE HISTORY



DOW CHEMICAL CO.

Power Plant of the Dow Chemical Co., Texas Division, Freeport, Tex., uses Illco-Way De-ionizing equipment (*above*) to treat 600 gpm of boiler-feed make-up water. Dissolved solids, silica, and CO_2 are removed by ionXchange.

The power plant operates seven Riley boilers, each at 250,000 lb. per hr., at 400 lb. 750°. These gas and oil fired steam generating units serve six turbo generators.

According to the plant's chief engineer, the most significant advantage resulting from

Illco-Way equipment, used in America's outstanding plants, includes the recently-developed Mixed-Bed De-ionizers, Hydrogen-Zeolite Units, Zeolite Softeners, Degasifiers, Filters.

the installation of this Illco-Way De-ionizing unit was the improvement of steam quality . . . "which has resulted in a marked increase in the duration of satisfactory operation of the turbine units between washing periods."

Equipment has enabled the plant to reduce phosphate additions by approximately 60%, further assisting in the reduction of the total solids within the boiler while still maintaining a proper phosphate ratio.

QUICK CALCULATOR

A handy ionXchange calculator for conversion of water analysis has been developed by Illco-Way. The easily-read sliding scale is used to convert ppm to gpg or gpg to ppm. Also ppm or gpg to gpg as $CaCO_3$. This accurate pocket-piece is helpful to anyone operating water treatment equipment or to engineers specifying such equipment. Request for one of these Calculators should be sent to Illinois Water Treatment Co., Rockford, Illinois, on your company letterhead.

NEW MIXED-BED DE-IONIZERS

Installed in many power plants, Illco-Way Mixed-Bed De-ionizers are producing feed water of extreme purity. Units provide an effluent of constant quality with a near neutral pH.

(Advertisement)

Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

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It appeared on page _____ of the _____ issue of POWER.

My Name .....
Please print

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Company .....

Street Address .....

City, State .....

This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

B1 **COOLING COILS**—Extended surface type. 72-page bulletin DS-365 describes coils for direct expansion refrigerants and chilled water in air conditioning or process applications. Performance and selection data, dimensions, specifications. Trane Co, La Crosse, Wis.

B2 **HEATING COILS**—Steam and hot water, standard and non-freeze types. 66-page bulletin DS-335 outlines capacities, selection, performance, dimensions of full line. Trane Co, La Crosse, Wis.

B3 **AIR CONDITIONING CABINETS**—*Model G* line. Horizontal and vertical units, 875 to 22,000 cfm. 40-page bulletin 3703A has capacity tables, diagrams, dimensions, photos. Buffalo Forge Co, 490 Broadway, Buffalo, N. Y.

B4 **UNIT HEATERS**—All-electric, automatic or non-automatic, portable and suspension types. 8-page catalog EC-62 has photos, specifications, wiring diagrams. Electromode Corp, 45 Crouch St, Rochester 3, N. Y.

B5 **HEAT MACHINES**—Supply heat at floor level. Portable, oil-burning units, capacities 130,000 to 140,000 btu per hr. 6-page bulletin L-4782 gives applications, condensed specifications. Fageol Heat Machine Co, 5725 Mt Elliott Ave, Detroit 11, Mich.

B6 **FANS AND BLOWERS**—Ventilating, exhaust, floor and window models. For office, home, industry. 24-page bulletin has photos, specifications. Standard Electric Mfg Co, West Berlin, N. J.

BOILERS AND AUXILIARIES

B7 **THERMAL COAL DRYER**—Capacities 15 to 75 tons per hr. *Verti-cone* unit is convection dryer of forced-draft type. 8-page bulletin gives construction, dimensions, uses. Robert Holmes & Bros, Inc, 510 Junction Ave, Danville, Ill.

B8 **BOILER TRIM** — Accessories, alarms, gauges, tryccocks. 16-page catalog 700 has cut-away diagrams, dimensions, construction features, ordering instructions. Wright-Austin Co, 8245 Wight St, Detroit 7, Mich.

B9 **WATER ALARM**—Signals high and low boiler-water levels. Connects directly to steam and water spaces of boiler drum, needs no water column. 4-page bulletin 493 gives operating principle, photos, specifications. Northern Equipment Div, Continental Foundry & Mach Co, Erie 3, Pa.

B10 **DUST COLLECTORS** — Cloth-tube type. Capacities upward from 252 cfm, assembled and knocked-down models. Specifications, cut-away views, installations. 36-page catalog 72-B. American Wheelabrator & Equipment Corp, Mishawaka, Ind.

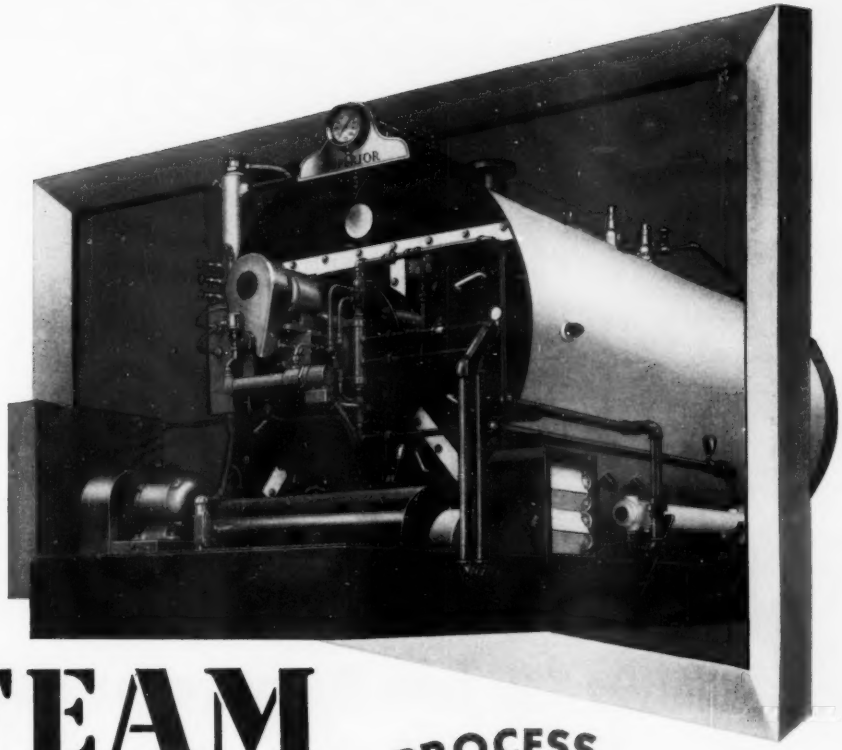
ELECTRICAL AND MECHANICAL CONTROLS

B11 **ELECTRONIC TRANSMISSION AND CONTROL**—6-page data release A-708 explains *Autronic* principle. Illustrates system components, shows unit installation, has typical flow control diagram. Swartwout Co, 19511 Euclid Ave, Cleveland 12, Ohio.

B12 **PORT VALVES**—For gas, air, oil, steam and water regulation. 12-page catalog 1200. *Air-O-Motor* diaphragm operators with North American adjustable port valves. Specifications, mounting dimensions. Minneapolis - Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B13 **TEMPERATURE CONTROL** — *Weather-Pic* unit anticipates weather changes, adjusts heat input to suit. 4-page bulletin gives construction and operation details. Automatic Devices Co, Inc, Western Springs, Ill.

(Continued on page 218)



STEAM
FOR HEAT OR PROCESS

A complete steam plant whose heavy duty construction assures long-lived dependability throughout years of hard usage.

- One purchase, backed by undivided responsibility.
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- More than 80% thermal efficiency guaranteed.
- 4-pass design provides ample heating surface . . . at minimum, 5 sq. ft. b.h.p.
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- Burner equipment to suit your fuel; gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.

If you are planning new or additional steam facilities, you'll want Catalog 401 which tells all you should know about packaged steam plants.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR
STEAM GENERATORS

Photo by Ewing Galloway

What Do You Take Me For, a Fathead?

THIS HIPPOPOTAMUS IS A DEAD RINGER for a chief engineer I worked for many years ago. It was an industrial plant and I had the day shift.

Shortly after starting, I got interested in the old dc switchboard. The fuses and knife switches were pretty dirty, so I started checking all of them.

Some fuse clips were badly burned. And I found double links in many cartridges. It was the old "penny in the fuse" practice, but I was surprised to find that in a plant.

"If this board's so sloppy," I thought to myself, "there must be plenty wrong with it." First off, I checked the generator's field rheostat settings. They were pretty high. Then I noticed the main-circuit-breaker trip arm was tied down. I untied it in a hurry. Then I set to work polishing the fuse clips, cartridge ends and knife switches with fine sandpaper. Next I got rid of all the double fuse links, and there were plenty.

Two days later, on my morning watch, the breaker kicked out. "What's going on here?" thundered the chief, tearing into the engine room.

I explained about untieing the breaker because I didn't want the generator to burn up.

"I tied that down because I don't want it kicking out," he yelled. Then he warned, "When I tie down a breaker, I want it left that way. WHAT DO YOU TAKE ME FOR, A FATHEAD?"

I've learned there are plenty of his kind around even today. They're heavyweights, all right. About as heavy as a hippo, and about as fast . . . mentally. They don't know why protective devices are built, and they don't take the trouble to find out—until it's too late.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

A Power Company asked: "Can you help us stop tube failures?"

Dowell Service provided a fast, effective solution!

A midwestern power and light company, operating 350,000 lb. per hour steam generators, was having numerous unscheduled shutdowns because of tube failures. Although tubes were turbined periodically and inspections showed that deposits were small in amount, tubes continued to blister. A crisis was reached when 11 outages occurred in 18 days!

Dowell Service provided the answer with a *more effective, faster and more economical* method of maintenance cleaning. Tube failures at this power house have been practically eliminated. A regular cleaning schedule using Dowell Service has solved similar problems in many other plants.

What is Dowell Service? Experienced engineers fill the equipment to be cleaned with special liquid solvents designed to dissolve and disintegrate the profit-stealing deposits from all surfaces, even the most complex, *in a few hours*. The solvents are carried to the job in Dowell pump trucks and are pumped into the unit through regular connections. There is no dismantling.

Call Dowell for consultation on your cleaning problems. A Dowell engineer is as near as your telephone. No obligation, of course.

Other recent Dowell jobs:

Anthracite filters cleaned by Dowell Service in one working day. Backwash rate increased from 75 to 385 g.p.m.

★

Five air conditioning compressors cleaned for office building in 8 hours by Dowell Service. Result: $15.70 per day saved on power demand.

★

Two 40,000 lb./hr. boilers cleaned for paper company in 24 hours. Result: 37 tons of fuel per day saved under same load conditions.

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New York 20	Pittsburgh 19	Ft. Worth 2	Mt. Pleasant, Mich.
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Buffalo 2	Houston 2	Hattiesburg, Miss.	Wichita Falls, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Hobbs, N. Mex.

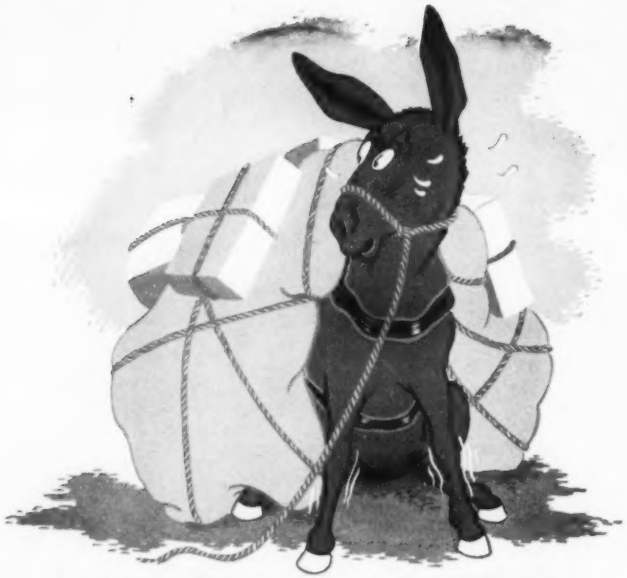
★ *Maintenance cleaning service for industrial heat exchange equipment.*

★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY



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We'll "custom-engineer" Leather Packings to suit your requirements

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We'll "custom-engineer" suitable leather packings for your applications . . . for high temperatures, extremely high pressures, and for most types of service.
Either Vee, Cup, Flange or U Packings.
The fact that we have produced special leathers for 250 years . . . guarantees highest quality workmanship, dimensional stability (because of our exclusive tanning process), and operating efficiency of our products.

Send your inquiry to J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia 6, Pa.

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Hydraulic Discs and Washers

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PHILADELPHIA • NEW YORK
CHICAGO • ATLANTA
YEARS PRODUCING FINE LEATHERS

More EQUIPMENT NEWS

Begins on page 156

combination. Pilot relay both amplifies and multiplies. Gages indicate air supply pressure and air pressure to diaphragm motor valve. Differential screw permits fine settings without gears or other mechanisms. Free-sliding fulcrum with locking-screw clamp allows proportional band adjustment from 1 to 100% of total range. Over-pressure safeguard, nozzle reversibility and a universal case are other features of this unit.

Pressure ranges go from 0-40 psi to 0-600 psi with bronze or stainless-steel bourdon tube. Ranges of 0-1000 psi and 0-1500 psi use stainless-steel bourdon. Pressure pilot is used on process systems in chemical, petroleum, power and other industries.

Minneapolis-Honeywell Regulator Co, Industrial Div, Wayne & Windrim Ave, Philadelphia 44, Pa.

For more data on these items, use post cards, p163. Identify request with P and number.

LAB COAL CRUSHER P344

Laboratory crushers were originally manufactured to crush and pulverize coal samples. They were intended to be used in coal testing laboratories of mining companies, utilities, industries, and commercial laboratories.

But in recent years, in addition to coal, other materials have been ground satisfactorily. Used welding flux, as produced by automatic machine welding, is one of the many products which have been ground successfully.

Robert Holmes & Bros, Inc, 510-520 Junction Ave, Danville, Ill.

HYDRAULIC CYLINDERS P340

Single and double acting hydraulic cylinders available in any of six clevis types. Line is built around a single basic design emphasizing simplicity.

Unit Mfg Co, 1221 Harmon Pl, Minneapolis 3, Minn.

MERCURY RELAY P347

Model EM-10 mercury plunger relay for three-wire operation. Can be used for lock-up relay service, off-on push button control

Why shoot birds... when there's b'ar around?

The few pennies you may save on initial cost for a lubricant are really *small game*. The *big savings*—such as reduced maintenance costs—come when you use Correct Lubrication!

For example . . . one plant, in the year following installation of a program of *Socony-Vacuum Correct Lubrication*, saved $66,000 on machine maintenance alone! In this same period, total cost of lubricants—including cutting oils—was only $50,000!

In addition to *maintenance* savings, Correct Lubrication also helps you achieve more continuous production, less power loss and lower over-all lubrication costs.

See what Correct Lubrication can do in *your* plant, mill or mine. Call your Socony-Vacuum representative today!

SOCONY-VACUUM

Correct Lubrication

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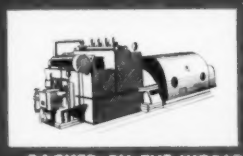
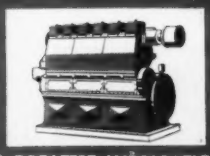
MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

The Right Oils for Turbines, Diesels...Every Machine in Your Plant





BACKED BY THE WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

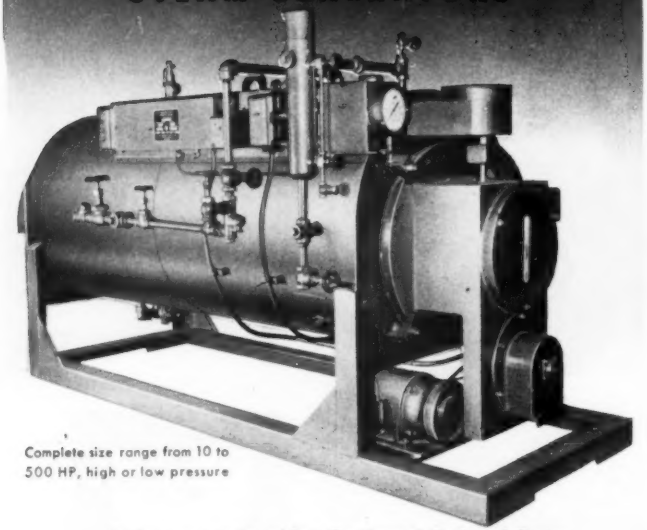
you get heating and processing

Steam at low cost

with easy-to-install

Continental

PACKAGED STEAM GENERATORS



Complete size range from 10 to 500 HP, high or low pressure

Savings you make with a Continental Packaged Steam Generator rapidly repay your initial investment. First, you save on installation. The unit is factory assembled and tested, ready to operate after simple service connections in your plant. Second, you save on fuel. The Continental operates with guaranteed efficiency of at least 80%. Independent tests prove the steam generated contains less than 1% moisture.

Of proven Scotch Marine design, this is a 2-pass boiler requiring far less refractory than ordinary 3- and 4-pass boilers. The fuel is burned in furnace entirely surrounded by water, and the gases pass spirally through 3" tubes, giving maximum heat transfer, low flue gas temperature, and high efficiency.

Third, you save on maintenance. Boiler front and back can be opened in 15-20 minutes, simplifying cleaning and servicing. Many users report these and other major savings with the Continental in heating and processing.

The unit is completely automatic and equipped with efficient burners for heavy oil, light oil, gas, or a combination.

May we send you literature that fully describes it? Call or write today.

BE

BOILER ENGINEERING AND SUPPLY COMPANY

330 Fourth Avenue • Phoenixville, Pa.

DISTRIBUTORS—PLEASE NOTE: A few choice territories are open. Request details on your company letterhead.

More EQUIPMENT NEWS

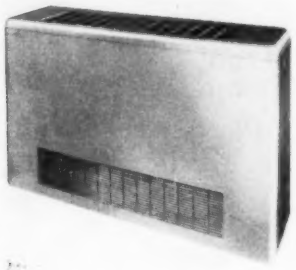
Begins on page 156

and so on. When contact is made the input line connects to the two isolated circuits.

Tungsten contacts are hermetically sealed in vacuum or hydrogen-filled glass tubes. Loads up to 35 amp at 115 v ac or 25 amp at 220 v dc can be handled by this new relay. Sealed construction allows for safe operation under all conditions. Elimination of exposed arc permits safe use in explosive atmosphere.

Ebert Electronics Co, 185-09 Jamaica Ave, Hollis, Long Island, N. Y.

For more data on these items, use post cards, p163. Identify request with P and number.

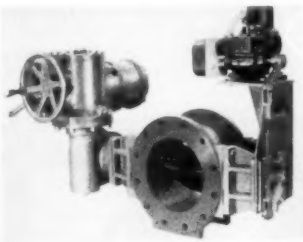


CABINET UNIT HEATER P301

Force-Flo heaters are designed for lobbies, entrances, showrooms and other locations needing a high volume of heat from an attractive source. Three new models of this six-unit line are the free-standing, Type FG, semi-recessed, Type SG and completely recessed, Type RG. All three models have front inlet and outlet grilles for blanketing doorways or other areas where air must be discharged horizontally from the unit.

Twin centrifugal fans push air over fin-and-tube heating coils. Units can be installed in steam or hot-water systems, with capacities up to 105,000 Btu.

The Trane Co, La Crosse, Wis.



DUAL-PURPOSE VALVE P320

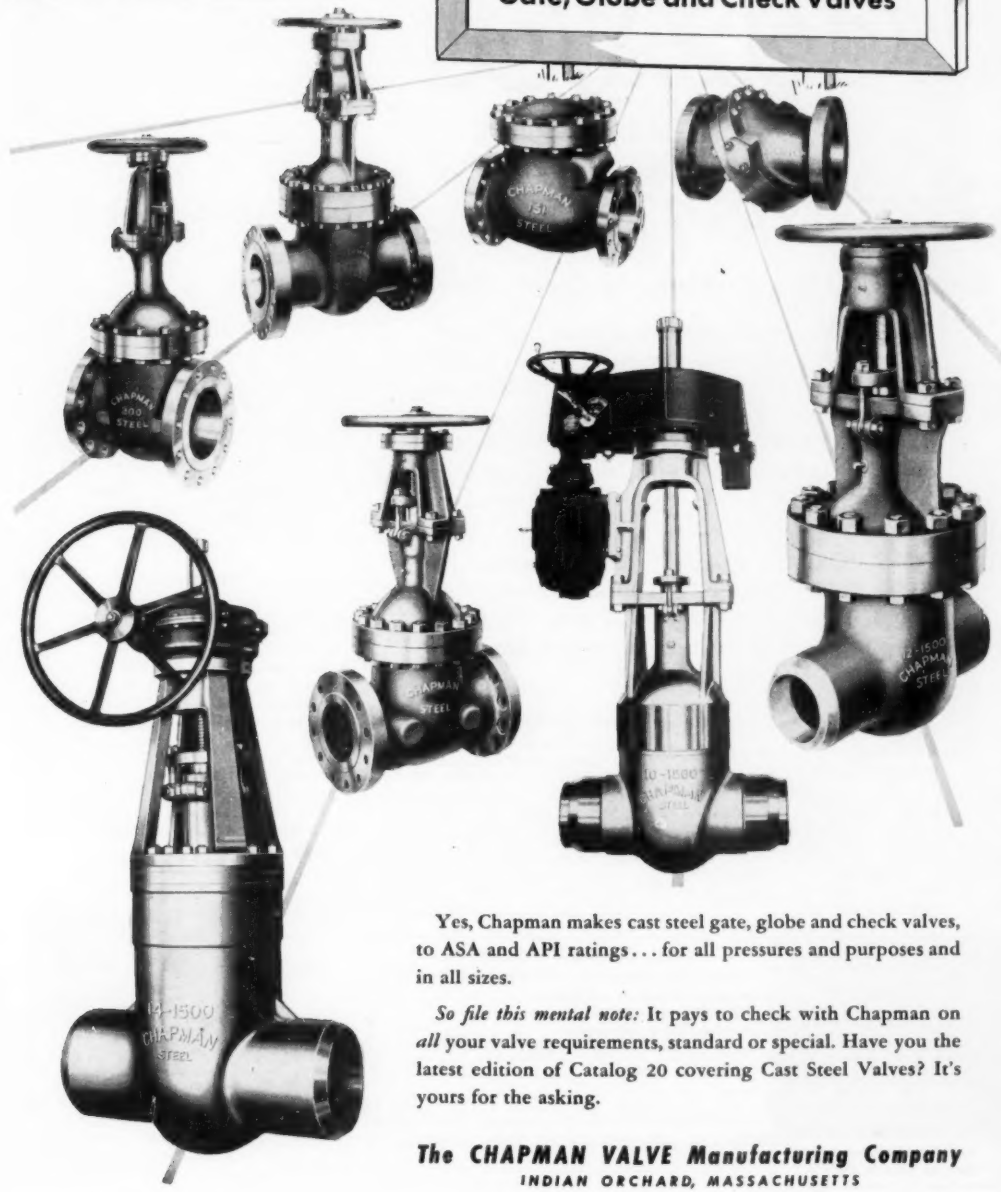
Valve No. 818 is a 125-lb cast-iron unit having a 12-in. beveled vane that seats against the body sidewall with a 4-in. vane mounted in the center of the larger vane.

Line Up With

CHAPMAN

for all Types and Sizes of Cast Steel

Gate, Globe and Check Valves



Yes, Chapman makes cast steel gate, globe and check valves, to ASA and API ratings . . . for all pressures and purposes and in all sizes.

So file this mental note: It pays to check with Chapman on *all* your valve requirements, standard or special. Have you the latest edition of Catalog 20 covering Cast Steel Valves? It's yours for the asking.

The CHAPMAN VALVE Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

Steam + CORAVOL = Protection (FROM CORROSION)

(The Original* AMINE PROCESS) ®

Because CORAVOL Circulates to Control Corrosion

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** *you* will use is formulated to do the best protective job under your own plant conditions.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for: boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

Western Chemical Company,
713 Washington Street,
Kansas City 6, Missouri
Send me full information about CORAVOL.

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____

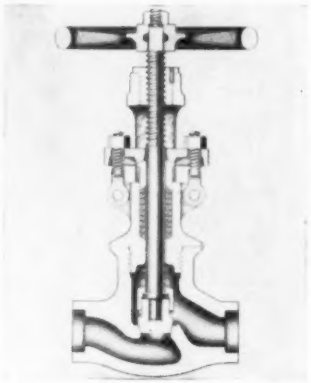
STATE _____

More EQUIPMENT NEWS

Begins on page 156

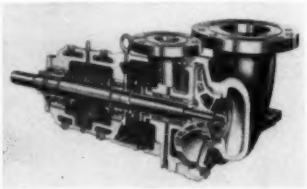
It is used in a turbine bypass line for controlling water flow when turbine isn't in use or when running at reduced capacity. Valve has 18-8 shafts, bronze bushings and two lubricated stuffing boxes with two outboard bearings. Both vanes are motor-operated. Available in various combinations of sizes and for elevated or sub-zero temperatures, either manual or automatic control. **R-S Products Corp. 4600 Germantown Ave, Philadelphia 44, Pa.**

For more data on these items, use post cards, p163. Identify request with P and number.



SMALL STEEL VALVES **P306**

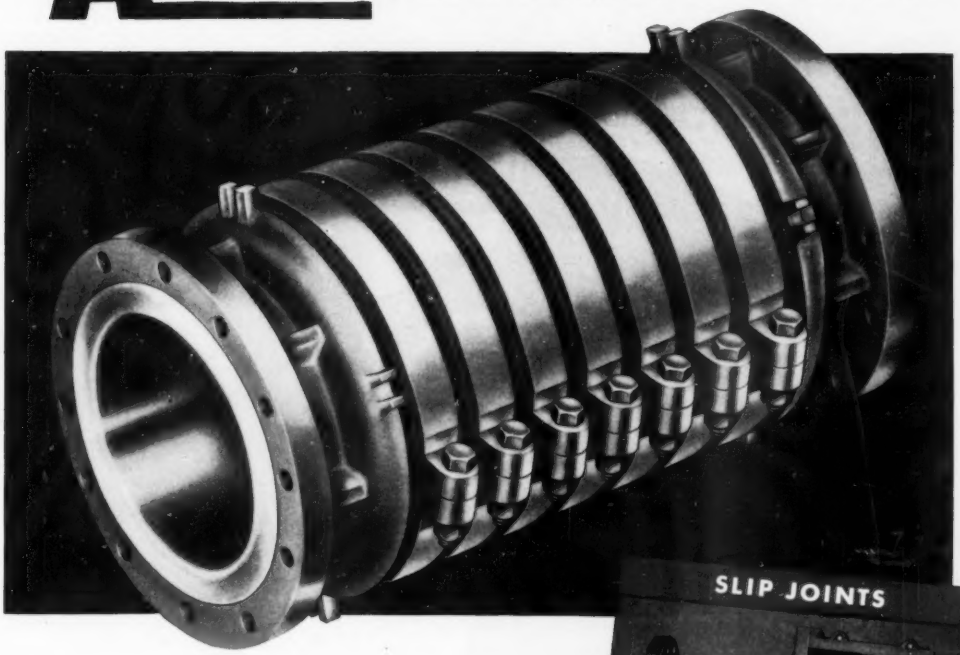
These small steel valves for high-pressure high-temperature services are made in globe and angle patterns for both 1500- and 2500-lb use. They are especially recommended for main steam, auxiliary steam, boiler feed, drips, drains, bypasses, blowdown and similar service. *Lip-Seal* bonnet joint provides absolute joint tightness, freedom from maintenance with minimum weight and bulk. Joint is easily dismantled and reassembled. *Lip-Seal* valves are offered in sizes from ½ through 2 in. with either socket-welding or screwed ends. **Crane Co, 836 S Michigan Ave, Chicago 5, Ill.**

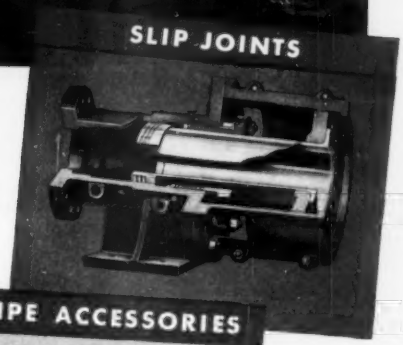


PROCESS PUMP **P305**

Type PR process pump handles up to 1000 gpm at heads to 625 ft, temperatures to 850 F. Horizontal motor drive standard but others like steam-turbine or stationary-

ADSCO EXPANSION JOINTS





We don't have to sell what you don't want to buy, because only ADSCO makes a complete line of expansion joints. The modern Corruflex, shown above, is the result of 50 years' experience in packless expansion joints. Equalizing and non-equalizing Corruflex joints cover wide temperature and pressure ranges and are built in many designs, including universal, tie-rod, hinge, and fully-guided. They will solve nearly all pipe-expansion problems caused by temperature differential, whether the material in the pipes is liquid, gas, or steam. Write for Bulletin 35-51.

ADSCO
75 YEARS OF LEADERSHIP

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK

See the Quality Yourself in the "Heart" of a Dart

The heart of a Dart — the non-corroding bronze seats — are specially ground by oscillating grinders to give *them* a true bearing surface — and give *you* an ABSOLUTELY LEAKPROOF JOINT.

What's more, Darts assure a drop tight joint without excessive wrenching — and they *stay* tight. You save on maintenance.

Body and nut of a Dart are other quality features that cut your costs. Made of practically indestructible, high-test, air-refined, malleable iron, they can take the toughest wrench "work outs" while protecting the joint. You'll like Dart threads too — full and clean-cut. And remember, Dart is the union you can use *over and over again.* It thrives on work!

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston New York Pittsburgh

DART
UNIONS

More EQUIPMENT NEWS

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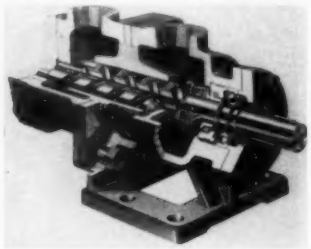
engine can be furnished. Liquid end made of cast iron, bronze, carbon steel, stainless steel or other materials, as needed. One model has top suction and discharge, the other has end suction, top discharge. Pump can handle petroleum hydrocarbons, water, and chemical solutions, depending on materials used in construction.
Peerless Pump Div, Food Machinery and Chemical Corp, 301 West Ave 26, Los Angeles 31, Calif.

For more data on these items, use post cards, p163. Identify request with P and number.



ROTARY PUMP **P311**

Imo A313B pump is a low-cost model, designed to handle a wide variety of oils at pressures up to 275 psi. Intermittent pressures to 325 psi are allowable. Capacities go up to 80 gpm. Applications include rotary and steam-atomizing burners, lubrication, governing systems and similar services.
De Laval Steam Turbine Co, Trenton 2, N. J.

FLUORESCENT BALLAST **P350**

Sequenstart fluorescent ballast is designed for two-96T12 fluorescent lamps. It meets the Certified Ballasts Manufacturers' Supplement No. 1, to American Standards Assn Specification C82.1.

This ballast, catalog No. 608-408, improves on all advantages of conventional lag-lead ballasts. It is cooler, quieter, lighter, smaller, more efficient and less expensive. Exclusive Sola ventilated capacitor compartment is retained to insure capacitor life and cool, quiet operation. Bulletin P-78 FL148 available on request.
Sola Electric Co, 4633 W 16th St, Chicago 50, Ill.

ALUMINUM TUBING **P338**

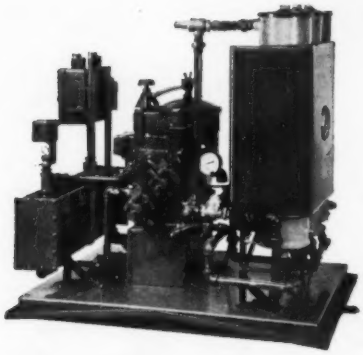
Utilitube is a general purpose aluminum coiled tube made of new Alcoa aluminum alloy B50S-0. Among its advantages are low cost per foot, easy workability and high fatigue strength.

The tubing can be used in fuel oil, gasoline and lubricating oil lines for internal combustion engines; in fuel gas lines for stoves and heaters; also in air, vacuum and hydraulic lines for brakes and instruments.

Utilitube costs substantially less per foot

INCREASES OIL LIFE

THE DE LAVAL "PURI-FILTER"



Note these Features

- Removes dirt and water by centrifugal force
- Filters out harmful carbon
- Does not remove valuable additives
- Cleans oil at moderate temperature
- Speeds up inspection—crankcase is cleaner
- Minimizes ring sticking
- Increases bearing life
- Saves labor—long runs without bowl cleaning

INCREASES OIL LIFE

No dirt . . . carbon . . . or water

Because it provides the best means ever devised for keeping diesel oil clean, the De Laval "Puri-Filter" extends the useful life of the oil indefinitely. Centrifugal force, applied within the bowl of a De Laval "Uni-Matic" Oil Purifier first frees the oil of most solid impurities and all water. Then the oil passes through a Fram "Filcron" Filter, which removes colloidal carbon and other minute contaminants.

The De Laval "Puri-Filter" leaves the oil a clear translucent amber color. It is ***visibly*** clean, and thus provides the utmost in protection for every diesel engine.

Used to purify fuel oil, a De Laval centrifuge makes it possible to burn cheaper grades of residual fuel with perfect safety and an appreciable saving of money.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL *Oil Purifiers*

FOR DIESEL LUBRICATING OIL

DRAFT FANS GO on GREEN

A Big Draft Job Handled Capably by Green Fans

Twenty-four large Green Fans take care of a heavy draft load at the Venice (Illinois) Plant of the Union Electric Co. of Missouri. Each of six boilers has two sets of Green Fans, each set consisting of one induced draft fan and one forced draft fan coupled to one motor as a unit. With the heavy demands on this station, all boilers are usually in service continuously, thus throwing an unrelenting burden on the fans.

Engineers whose responsibility it is to recommend or accept draft fans for large power plants certainly want efficiency and low operating costs. But they don't overlook the maintenance and replacement angles. They want the sound designs of competent experienced fan engineers. They also want the care in construction that is found in shops of a company that has built up an international reputation as the "authority" on draft fans. They know that such a company will not tolerate sloppy shop work.

Green is this authority on mechanical draft fans.

Have You a Copy of Our Fan Bulletin No. 168? If not, we shall be glad to send you one.

THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More EQUIPMENT NEWS

Begins on page 156

than copper and less than other strong aluminum alloys. If desired, it may be had in lengths up to 1000 ft or more, depending on size.

Aluminum Co of America, 683 Gulf Bldg, Pittsburgh 19, Pa.

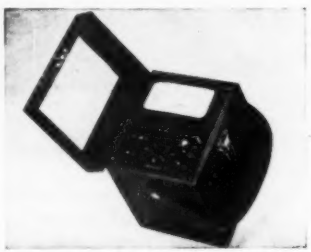
For more data on these items, use post cards, p163. Identify request with P and number.

WATER-OIL SEPARATOR P345

PurDry separator removes water from turbine, hydraulic, or any industrial oil. Unit will reduce water content of oil to less than 1/10%.

Use of separator eliminates need for changing or discarding oil regardless of type of contamination. *PurDry* performs a complete filtering service for removal of solid contamination, acids and other sludge-forming products of oxidation as well as water separation.

Honan-Crane Corp, 200 Superior Ave, Lebanon, Ind



PRECISION OHMMETER P349

ARI precision ohmmeters, Models 244A and 246A, lick the problem of change in internal resistance in batteries due to aging. They are therefore capable of high accuracy in a small, self-contained unit.

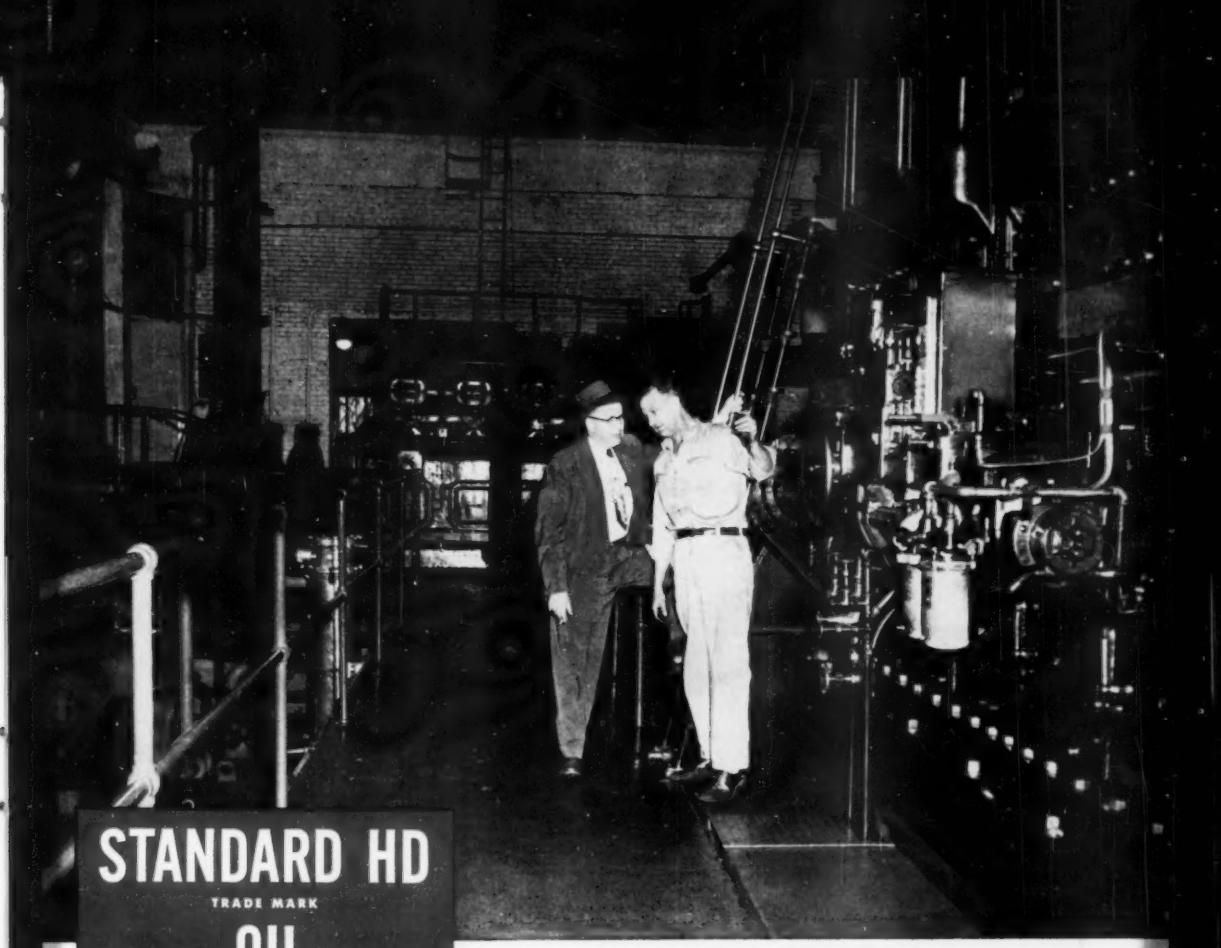
Model 244A has ranges of 0-50; 0-500; 0-5,000 and 0-50,000 ohms, with lowest cardinal point of .05 ohm at ⅛-in. distance from zero. Model 246A has ranges of 0-100; 0-1000; 0-10,000 and 0-100,000 ohms, with lowest cardinal point of .05 ohm at 1/16 in. from zero.

Batteries are two standard No. 6 dry cells. Instrument dimensions are 7¼ x 6⅛ x 7½ in. Weight is 11¼ lbs with batteries.

Associated Research, Inc, 3770 W Belmont Ave, Chicago 18, Ill.

HEAT EXCHANGERS P315

For heating or cooling, these shell-and coil assemblies have basic ratings from 98 to 1760 Btu per hr. They can be used for: (1) watercooled refrigeration condensers, converting air-cooled compressors to water-cooled, combined condenser and receiver, or (2) heating oils, chemicals or water with steam, and for other similar jobs. Body is ASME welded construction. Coil



Solves a diesel maintenance problem

• Excess cylinder and ring wear plus sludge, varnish, and carbon deposits posed a costly maintenance problem for operators of this municipal power station. Overhauls were scheduled every six months. A full set of rings was installed at every overhaul. That was the situation in 1947 when a Standard Oil lubrication specialist recommended changing to STANDARD HD Oil.

The change was made on one of the station's five diesels. These are the results with STANDARD HD.

Time between overhauls has been doubled, and normally only the two top rings are changed. Cylinder wear has been cut to a minimum, even with the engine operating under heavier loads. The engine has remained clean and there has been no ring sticking. Efficiency has been stepped up from an average of 12.0 KW per gallon of fuel to 12.5 KW per gallon.

These results, the solution of a costly maintenance problem, have led to the use of STANDARD HD Oil in the station's four other diesels. Chances are that a Standard Oil lubrication specialist can help you achieve similar results in the operation and maintenance of your own diesel equipment. Put him to work on your problem today. A call to your local Standard Oil Company office is all that's necessary. Or write: Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

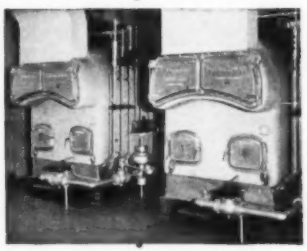
STANDARD OIL COMPANY STANDARD *(Indiana)*

Santa Rosa Hospital Built for Reliability . . .
and Selected

KEWANEE

HEAVY-DUTY BOILERS

SANTA ROSA HOSPITAL, San Antonio, Tex.
PHELPS, DEWEES & SIMMONS, Architects
GUARD M. BAKER, Engineer
JUD PLUMBING & HEATING CO., Heating Contractors



By specifying Kewanee Heavy-Duty Boilers, for 100, 125 or 150 pounds working pressure, large institutions can be certain of dependable heat at all times with an ample reserve for emergencies . . . *plus high pressure steam* for kitchens, laundries, sterilization and other equipment.

Pictured is the Santa Rosa Boiler Room with its battery of 2 Heavy-Duty Kewanees each of 270 HP . . . producing a total of 15,000 lbs. steam hourly.

FOR HEATING, POWER AND INDUSTRIAL PROCESS STEAM

Wherever steam is needed . . . *high or low pressure* . . . there is a Kewanee Boiler just right. Ask for complete catalogs and information.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

Heating America's Finest Buildings

KEWANEE BOILERS

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · ACME CABINETS · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

More EQUIPMENT NEWS

Begins on page 156

tubes are copper on all sizes except for oil treating when steel coil is used. All-steel construction recommended for ammonia refrigeration service.
Rempe Co, 340 N Sacramento Blvd, Chicago 12, Ill.

For more data on these items, use post cards, p163. Identify request with P and number

EMERGENCY LIGHT P327

This automatic emergency lamp gives light when regular power fails. Plugs into any 110 volt ac outlet. If there should be any interruption in the regular lighting circuit the GS No. 16 light will come on instantly and automatically, from power supplied by a dry battery.

Light clamps on to a standard 6 or 7½ v dry battery. The powerful 21 cp floodlight will give many hours of emergency light; the lamp is adjustable in any direction.

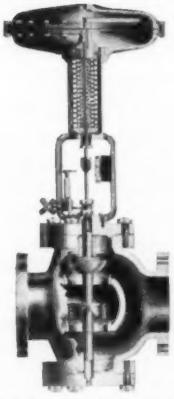
Unit is self-contained, portable, can be carried for rescue or emergency work. Furnishes emergency light for operation of switches, valves, controls and for making repairs. Enables employees to remain on premises during a reasonable interruption.
General Scientific Equipment Co, 2700 W Huntingdon St, Philadelphia 32, Pa.

LIQUID STEEL COATING P337

Stainless steel is reduced to a microscopically fine form (flakes) and combined with vinyl plastics to form a quick-drying liquid. This will give a surface of actual stainless steel in coating form to protect against rust and corrosion. Metals, wood, composition board, concrete and brick can be given much of the permanence of the metal itself.

The coating of type 18/8 No. 302 stainless steel offers impermeability to moisture. It is easy to apply. The metal is in the

76 BS&B CLIMAX CONTROLS CENTERS



CLIMAX TYPE 86
Diaphragm Control Valve. One of the most widely used controls in the Climax line.

Your Fastest, Most Efficient Service

In 29 states and 3 Canadian provinces 76 BS&B Climax Controls sales and service centers are prepared to meet your needs for fast, efficient, convenient service on automatic controls for regulating flow, levels, temperature, pressure and power. From these centers, including 43 strategically located warehouse stocks of Climax Controls and parts, Climax sales engineers are quickly available to render service on existing equipment or to help you plan new installations.

The widespread, closely integrated Climax organization is a definite assurance that your machinery and processes will function at maximum efficiency and with minimum interruptions when equipped with BS&B automatic Climax Controls.

Climax Controls catalog will be sent to you promptly at your request.

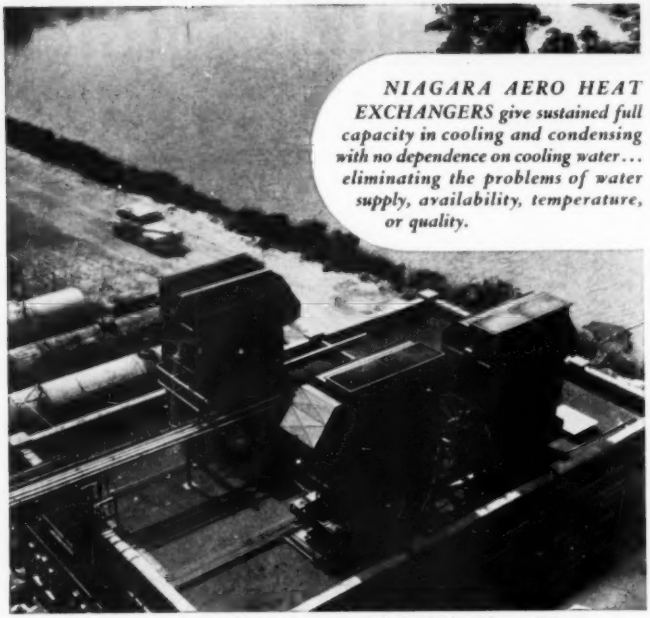
CLIMAX BS&B CONTROLS

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division Dept. 4-Q3

7500 E. 12th Street — Kansas City, Missouri

Climax Controls Factory: Tulsa, Oklahoma — *Oil & Gas Equipment Div: Oklahoma City, Oklahoma*


NIAGARA AERO HEAT EXCHANGERS give sustained full capacity in cooling and condensing with no dependence on cooling water... eliminating the problems of water supply, availability, temperature, or quality.

Niagara Aero Heat Exchangers at a Plant of the Heyden Chemical Corp.

Still Operations Improved by a New Cooling Method

• NIAGARA AERO HEAT EXCHANGERS cool the reflux supply or condense vapors at a vacuum by controlled evaporation of water directly on the heat exchange surfaces.

Liquid or vapor temperatures are always held constant by the Niagara "Balanced Wet Bulb" control method, which automatically varies the cooling effect proportionately to the load. The distillation is therefore uniform throughout all changes in climatic conditions the year around; it is the same in the heat of summer as in the freezing cold of winter. Continuous maximum production is thus insured.

Non-condensibles are effectively separated at the condensate outlet, with notable sub-cooling after separation for greater vacuum pump efficiency.

Use of Niagara Aero Heat Exchangers reduces your operating costs and removes many sources of your troubles in distillation column operation. Ask for new bulletin #120.

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. P, 405 Lexington Ave. **New York 17, N. Y.**

Experienced District Engineers in all Principal Cities of U. S. and Canada

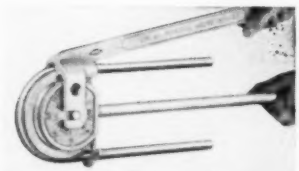
More EQUIPMENT NEWS

Begins on page 156

form of flakes that overlap and interlock as the coating dries, presenting an almost continuous barrier of stainless steel to corrosive materials. Liquid stainless steel can be sprayed, brushed or dipped as outlined in bulletin.

Slip-On Inc, 401 Broadway, New York 13, N. Y.

For more data on these items, use post cards, p163. Identify request with P and number



TUBE BENDER **P310**

This two-piece unit bends both ½ and ⅝ in. OD copper, aluminum, brass and other soft thin-wall metal tubing. Dual-size shoe and mandrel permits two different tubing sizes without changing parts. Tubing with one end connected can be bent as easily as tubing with both ends free. Bends can be made to any angle up to 180 deg. Calibration shows degree positions. Bender overall length is 21 in., weight 3 lb.

Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill.

WELDING ELECTRODE **P341**

Nickel-free electrode for cast iron, *EutecTrode 27*. While this new rod does not replace nickel-bearing electrodes on all applications, it is said to offer an extremely high-tensile weld with a uniform amount of carbon in the deposit. The deposited material is similar to a high-tensile, high-carbon steel.

Eutectic Welding Alloys Corp, Dept P, 172nd St and Northern Blvd, Flushing, N. Y.

AIR CONDITIONER **P316**

Window-mounted air conditioner projects only 9½ in. into room, has 8800 Btu-per-hr cooling capacity. Unit has ¾-hp hermetically-sealed Freon-12 compressor, two blowers, and handles 300 cfm. Moisture removal is 2.5 pints per hr. Conditioner fits 27 to 48 in. windows, weighs 197 lb.

O A Sutton Corp, Wichita, Kan.

WATER LEVEL ALARM **P334**

Designed primarily for high-pressure service, the *Hi-Lo* water alarm is dependable at all working steam pressures on both stationary and marine boilers. It uses no bellows, no diaphragms, no weights, no floats, no differential pressure devices. It

Drop Forged SteelS

W-S Screw-End and Socket-Weld Fittings

That's right, W-S emphasizes the *plural* when it comes to the various steels for forged fittings.

From Monel down to the full range of carbon types, including low sulphur and phosphor-controlled grades, W-S *forged* fittings spark the trend toward specialized materials for specialized needs.

What's your problem? STRENGTH? W-S is a leading supplier to the high-pressure, high-temperature power industry. CORROSION? W-S stainless and alloy fittings tie America's main arteries of chemical production. SANITATION? W-S is a big producer of the popular Type 304 for food and pharmaceutical operations. Low temperature? Another W-S specialty.

And there's one problem common to all . . . COST. Let us show you how W-S *forged* fittings provide the lowest *service* cost obtainable.

• Stronger • Smaller • Lighter • Tighter
• More Uniform • Lower Service Cost

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Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

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Die-Cast

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Your Magnolia Distributor

Look to your Magnolia Distributor for a dependable localized source of service and supply for all your bronze bearing metal requirements. Backed by Magnolia's years of experience and research, your Magnolia Distributor can be a big help during these difficult days of shortages and high production requirements.

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MAGNOLIA METAL COMPANY

21 West Jersey Street • Elizabeth, New Jersey

More EQUIPMENT NEWS

Begins on page 156

has no internal parts to wear or corrode. Standard audible signal is a horn; standard visible signal, lights.

Device is easily installed without special supports or complicated piping, with or without a water column. It is illustrated and described in Bulletin 493.

Northern Equipment Div, Continental Foundry and Machine Co, Erie 2, Pa.

For more data on these items, use post cards, p163. Identify request with P and number.

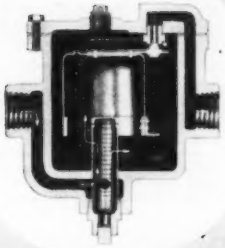
TEMPERATURE RELIEF VALVE P321

Valve No. 201 is rated for heat inputs up to 1,200,000 Btu per hr, is of the automatic reseating type to prevent excessive water temperatures in hot-water tanks and heaters. Body is a brass casting, disk is silicone rubber. Suitable for pressures up to 125 psi. All connections are ¾-in. tappings.

McDonnell & Miller, Inc, 3500 N Spaulding Ave, Chicago 18, Ill.

CORROSION-RESISTANT DUCTS P308

Uscolite ducts are made of tough, corrosion-resistant plastic throughout. No other material is used, reinforcing ribs, joints and corners being extruded from plastic. Sheets form tops, sides and bottoms. Rivets are injection molded from the plastic while bolts are machined from extruded tube stock. Joints are solvent-welded with the same plastic in solution to form an airtight assembly. Plastic ducts



Here is one of the four different traps made by Sarco—the Inverted Bucket Steam Trap with straight-thru connections for easy inspection. Mechanism is attached to the cover; accessible without disturbing pipe connections. Since 1936 all sizes have been factory-equipped with integral strainers at no extra cost. REAL capacities are exceptionally large.

KIMBALL LAUNDRY CO.

June 5, 1951

Sarco Company, Inc.
Empire State Building
New York, New York

Gentlemen:

Before standardizing on Sarco traps, we used many different makes in an attempt to find one that would be suitable from a service and maintenance standpoint.

At the present time our plant is equipped approximately ninety per cent with Sarco traps. This conversion has taken place over the past three years.

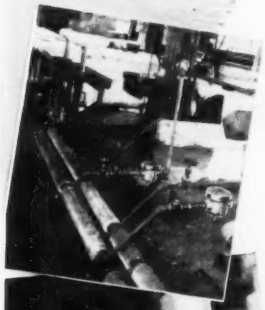
Sarco traps gave us the thing we had been looking for — uninterrupted service with a very minimum maintenance.

Yours very truly,

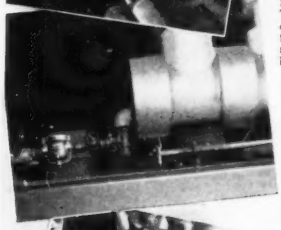
KIMBALL LAUNDRY COMPANY

A. J. Hayethayer
Secretary

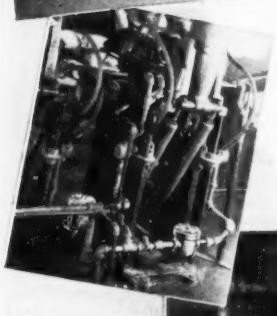
AJ:feb



On steam irons for silks, the Sarco steam traps assure absolutely dry steam.



Sarco Steam Traps removing condensate from main steam header at boiler.



Sarco Steam Traps draining collar and cuff ironers.

Sarco Steam Traps keeping drying tumblers free of air and condensate.

"uninterrupted service

with a very minimum maintenance"

The letter above speaks for itself. Kimball Laundry is one of the largest west of Chicago. While it was founded in 1886, its equipment today is among the most modern. You too can have "uninterrupted service with a very minimum maintenance," by using

SARCO STEAM TRAPS

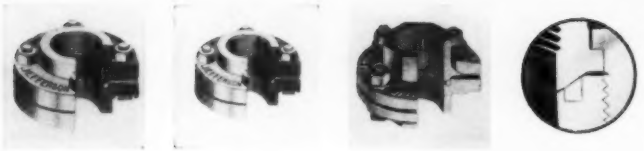
Just install one in the toughest spot in your plant and let it prove itself—it will! Sarco makes four distinct *types* of traps and can fit the trap to the job. Our manual "Steam Hook-ups" explains how and provides a convenient selection chart.

Write for your free copy today. 358

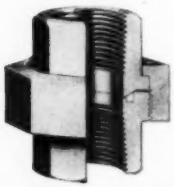
SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.
SARCO CANADA LTD., TORONTO 8, ONTARIO

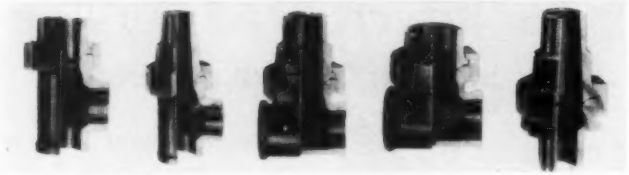
REPRESENTED IN PRINCIPAL CITIES



Permanently tight
PIPING SYSTEMS
for all piping needs



Jefferson
AIR-TESTED AIR-REFINED MALLEABLE IRON
UNIONS
featuring the RECESSED BRASS SEAT



With Jefferson's complete line of Specialty Unions you have an opportunity to standardize on a tried and proved means of assuring permanently tight piping systems.

Jefferson's exclusive Recessed Brass Seat, demonstrated over many years service, can be depended on for drop-tight performance. Located in a recess away from the runway of the fitting, this self-seating ball joint is protected from pipe ends should they be screwed in too far. The joint itself is provided by a *machined* brass ring press-fitted into a *machined* recess, with seating surfaces machined and ground together to a true spherical contour.

The Jefferson line includes AAR male and female unions, Enduro 300#, Excel 250#, and Master 150# Unions. All-iron seats are also available in all types.

Ask your nearest distributor—or contact us direct—to supply your needs.

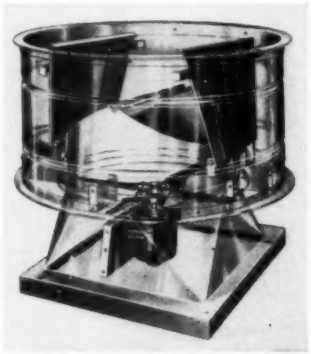
Jefferson UNION CO.
605 W. 26th ST., NEW YORK 1, N.Y.
83 Gooding St., Lockport, N.Y. 39 Fletcher Ave., Lexington 73, Mass.

More EQUIPMENT NEWS

Begins on page 156

are cheaper than stainless steel and more durable than ordinary galvanized metal, or wood. They are relatively light and suitable for use with acids, alkalies, aliphatic hydrocarbons and other basic chemicals.
United States Rubber Co, Rockefeller Center, New York 20, N. Y.

For more data on these items, use post cards, p163. Identify request with P and number.



POWER VENTILATOR **P313**

Designed for rapid localized removal of air contaminated with smoke, fumes, dust and heat, these units have capacities ranging from 5000 to 75,550 cfm. Unit is made in seven sizes with motors from 1/3 to 5 hp. Dampers above fan open and close automatically as fan starts and stops. Air is driven vertically upward at high velocity by the axial-flow fan.
Burt Mfg Co, Dept PO, 927 S High St, Akron 11, Ohio

ELECTRIC COMFORT HEATER **P309**

Glareless all-metal electric heaters are suitable for local heating of men or equipment, either indoors or outdoors. Standard units are equipped with 6 in. of BX cable, a plug and two movable mounting clamps and bolts. Readily adaptable to many locations, heaters can be bolted alongside machines, on portable rigs or laid on floor to warm worker's legs. Three models are available: 800 w, 24½ in. long, 1100 w, 30⅞ in. long, 1800 w, 46¾ in. long. First two use 115 or 230 v, last 230 v only.
E L Wiegand Co, 7731 Thomas Blvd, Pittsburgh 8, Pa.

"Tycol Aturbrio resists heat and sludging... turbines operate for years without shutdown"

Correct! Tycol Aturbrio Oils resist emulsification, foaming and deterioration even when turbines operate continuously. Oiling systems stay clean longer—uninterrupted service is assured. Tycol Aturbrio Oils are "double inhibited" to give utmost rust and oxidation resistance. They keep costs down... hold wear to a minimum.

For further information, get in touch with your nearby Tide Water Associated office. Write or wire today.

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TIDE WATER ASSOCIATED OIL COMPANY

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. . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

Mundet Cork Corporation

Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

Mundet district offices are located in these cities:

ATLANTA 339-41 Elizabeth St., N.E.
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CHARLOTTE 3, N. C. 507 S. Cedar St.
CINCINNATI 2 427 West 4th St.
DALLAS 10 601 Second Ave.
DETROIT 32 14401 Prairie Ave.
HOUSTON 1 Commerce and Palmer Sts.
INDIANAPOLIS 4 15 E. Washington St.
JACKSONVILLE 6, FLA. 800 E. Bay St.
KANSAS CITY 7, MO. 1401 St. Louis Ave.
KNOXVILLE 1221 Grand Ave.
LOS ANGELES (Maywood): 6116 Walker Ave.
In Canada: Mundet Cork & Insulation, Ltd., 35 Booth Ave., Toronto
NEW ORLEANS 16 315-25 N. Front St.
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PHILADELPHIA 39 856 N. 48th St.
ST. LOUIS 9 2176 Brannon Ave.
SAN FRANCISCO 7 440 Brannon St.

INSULATION FOR HIGH & LOW TEMPERATURE

More TECHNICAL BRIEFS

Begins on page 150

sidered: first, whether a waste heat boiler will perform the desired function, and second, whether the equipment is designed to meet the specific conditions.

Heat transfer is a broad operation that takes in many types of equipment and media. This paper covers the steam boiler including the steam superheater and feed water economizer. Liquids having thermodynamic properties differing from water may be used, in which case the same general principles will apply. *ASME Paper. No. 51-A-126.*

Bearings

Oil Flow, Key Factor in Sleeve Bearing Performance. *By Donald F Wilcox and Murray Rosenblatt, General Electric Co.*

Determining and understanding the performance characteristics of cylindrical sleeve bearings is based on three relationships. (1) Viscosity-temperature characteristics of the lubricant (2) bearing power consumption as a function of oil film temperature (3) oil flow through the bearing as a function of Sommerfeld number. This paper is concerned primarily with the nature and quantitative determination of oil flow, and with the possible simplified methods for calculating bearing performance.

The discussion is restricted to bearings having oil pressure-fed to their oil distribution grooves. Oil flows from the ends of these bearings because of (1) the pressure in the oil grooves and (2) the pressures generated in load-carrying portion of the oil film. The second type of flow depends on shaft speed. Dimensionless parameters controlling both types of flow have been calculated, and experimental results on several bearing sizes confirm the theory.

A detailed study of the circumferential flow of oil in the bearing shows that Petroff's law is an excellent approximation of power loss up to an eccentricity of 0.7, and that the temperature variation in the oil film may be estimated with simple assumptions.

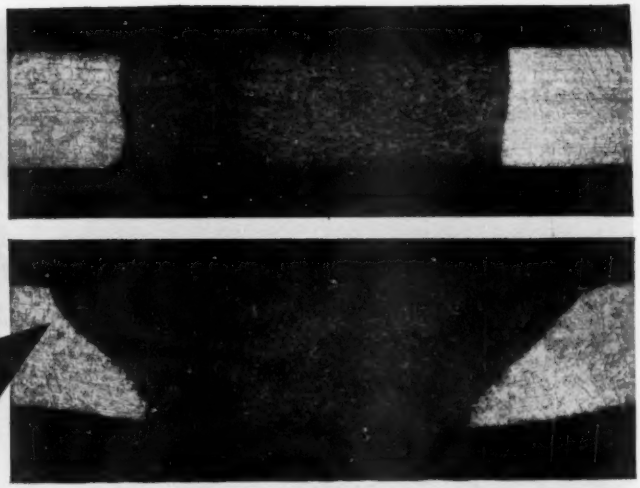
Knowledge of bearing oil flow characteristics permits ready calculation of bearing performance by means of the operating line method. *ASME Paper. No. 51-A-89.*

Directions for ordering papers on p 152

Life of High Speed Ball Bearings. *By A B Jones, Fafnir Bearing Co.*

Modern jet engines require large ball bearings for heavy loads at very high speeds. Conventional calculations of

HERE'S WHY ZALLEA EXPANSION JOINTS



Top: Weld bead of Zallea Expansion Joint.
Bottom: Weld bead of competitive expansion joint.

...Offer You Longer Service Life!

For years, expansion joint manufacturers have talked in general terms about "quality", "dependability", "economy", and the like. But these words have no real meaning to you as a user of expansion joints unless they are backed up by facts... and conclusive proof!

When we point out that Zallea Expansion Joints offer you *longer* service life, here's what we mean:

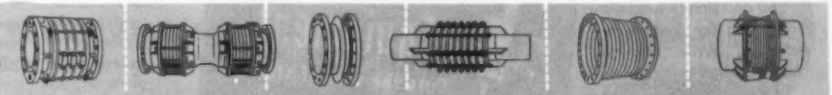
It's an accepted fact that the life of a corrugated expansion joint varies inversely with the thickness of the metal. Therefore it is essential that a corrugated bellows have uniform thickness throughout. Only in Zallea Stainless Steel Expansion Joints are you assured of this optimum condition because Zallea alone produces a longitudinal weld of the same thickness as the parent metal without grinding.

Accelerated flexing tests of many corrugated bellows proved that the resultant welding bead of a shielded arc weld was detrimental to the life of the bellows because failure always occurred across the weld—thickest section of the bellows. Zallea metallurgists analyzed many welding processes and found that by adopting an exclusive variation of the Heliarc process and adding a grain refining procedure to the finished weld, they could produce a corrugated bellows that under brutal flexing tests to destruction, *failed in the parent metal only.*

In over 100 bellows tested with Zallea controlled welding, not one failure occurred within 30 degrees of the weld line. More important was the fact that these bellows lasted as much as *8 times* longer than bellows having a shielded arc welding bead! Compare these two unretouched photomacrographs. See for yourself why it is to your advantage to buy Zallea when you want the best in expansion joints. Zallea Brothers, 814 Locust St., Wilmington 99, Delaware.

For complete information on all Zallea Expansion Joints, write for Catalog 47. You'll also want a copy of Bulletin 351 for quick reference. Ask for it too!

Zallea
EXPANSION JOINTS



WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

Stickle System cuts canner's fuel costs and cooking time 50%

An Ohio canning and processing plant, handling 100 tons of tomatoes per day, installed the Stickle Differential Drainage and Boiler Return System shown below. RESULTS: Coal consumption cut from 10 to 5 tons a day; firemen reduced from 4 to 2; condensate returned to boilers at 325°; at 100 lbs. boiler pressure, cooking time for tomato puree reduced from 35 minutes to 16 minutes for 1.05 specific gravity. Stickle System *paid for itself the very first season installed!*

Let us show you how this Stickle System will save *you money*. Minimum fuel saving for your operations is *guaranteed* before installation. And performance precedes payment—you must be satisfied! Send for *free* details below.*

STICKLE STEAM SPECIALTIES COMPANY
2265 Valley Ave., Indianapolis, Ind.

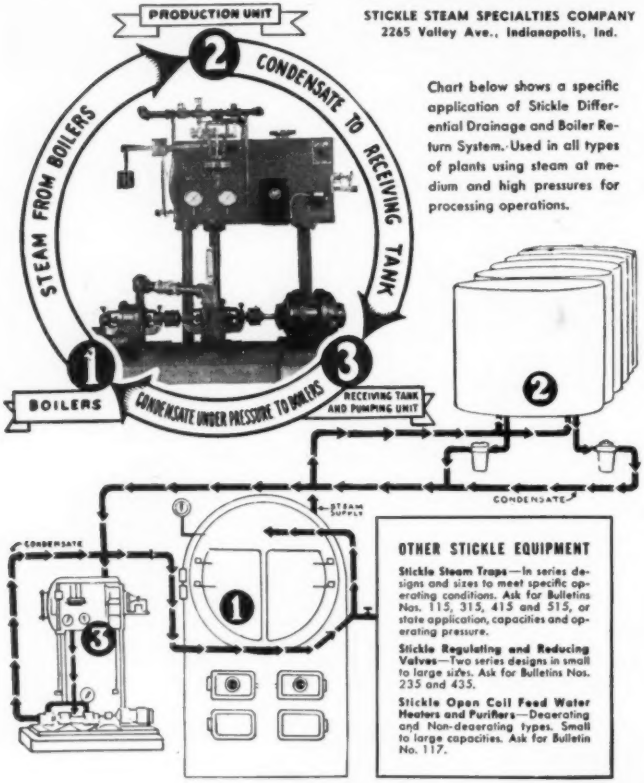


Chart below shows a specific application of Stickle Differential Drainage and Boiler Return System. Used in all types of plants using steam at medium and high pressures for processing operations.

OTHER STICKLE EQUIPMENT

Stickle Steam Traps—In series designs and sizes to meet specific operating conditions. Ask for Bulletins Nos. 115, 315, 415 and 515, or state application, capacities and operating pressure.

Stickle Regulating and Reducing Valves—Two series designs in small to large sizes. Ask for Bulletins Nos. 235 and 435.

Stickle Open Coil Feed Water Heaters and Purifiers—Deaerating and Non-deaerating types. Small to large capacities. Ask for Bulletin No. 117.

***FREE!** A copy of above canner's letter, plus generously diagrammed Bulletin 250 and simple estimate data sheet for System installation. Write address above—*today!*

More TECHNICAL BRIEFS

Begins on page 150

bearing life are based on the fatigue of the components due to the externally applied loads. At high speed the centrifugal force on the balls increases the probability of failure of the outer race in the case of radial type ball bearings under radial load, and hence reduces bearing life.

In angular contact bearings operating under thrust load, centrifugal loading of the balls tends to produce a higher operating contact angle for the inner race than the outer. Thus the relative probabilities of outer and inner race failure are different from those calculated from static loading, and bearing life is accordingly different. The theoretical conditions outlined in this paper have not been confirmed by a formal series of life tests. *ASME Paper. No. 51-A-69.*

Hydro Turbines

Runaway Speed of Kaplan Turbines. *By G H Voaden, S Morgan Smith Co.*

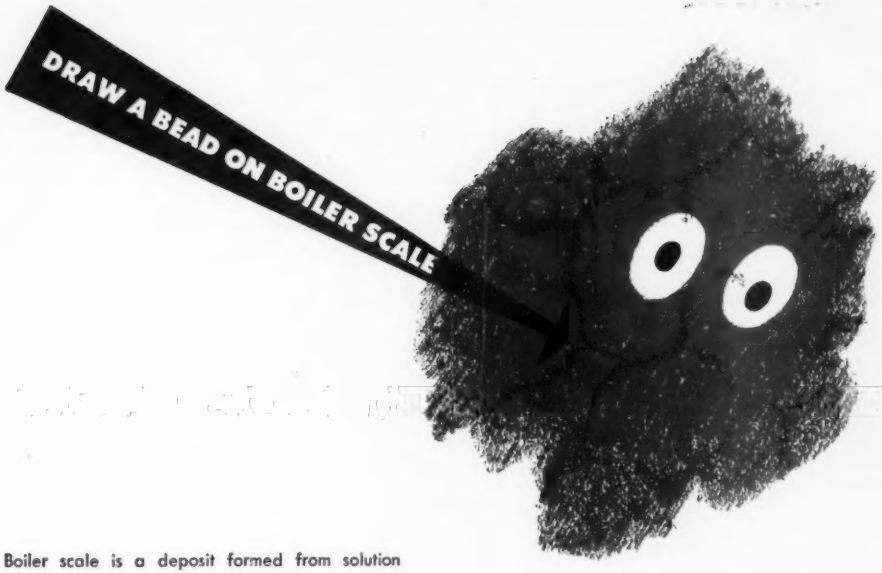
The author presented his paper with these five points in mind: (1) Illustrate the type of laboratory test data that a turbine manufacturer must have to predict intelligently the runaway speed of a Kaplan turbine. (2) Point out the significant differences between the *on cam* and *off cam* runaway speeds. (3) Present data on actual runaway speed tests conducted on a large Kaplan turbine installation. (4) Call attention to the possibility of reducing the runaway speed by restricting the minimum angle to which the runner blades can be pitched. (5) Provide information that will aid the purchaser of a Kaplan turbine to decide what runaway speed should be provided for in the generator.

The runaway speed of Kaplan turbines is in general, 2.5 to 3 times normal speed whereas with Francis turbines it is rarely over twice normal. This high runaway speed requires greater understanding and consideration in design by manufacturers, purchasers, operators, and generator manufacturers. *ASME paper. No. 51-A-100.*

Directions for ordering papers on p 152

Highlights of Recent Developments in Francis Turbines. *By W J Rheingans, Allis-Chalmers Mfg Co.*

Major developments have been in materials of construction. Use of welded plate steel for spiral cases in place of cast steel, for example, has shown possible savings of 14% in overall weight and 13% in total cost of the



Boiler scale is a deposit formed from solution directly in place upon a confining surface. It is crystalline and dense and usually retains its physical shape when removed. (Ref. ASTM D 887, D 933).

Use DREW POWER CHEMICALS

No boiler is exempt from scale under present day operating conditions. Scale results in tube failure, plant shut-down, trouble and inconvenience. It's the duty of every good water treatment company to recognize and solve this problem.

Draw a bead on boiler scale! Call in the Drew Engineer. The water samples and operating data that he obtains in your plant will be thoroughly analyzed in the Drew Laboratories, and you'll be given specific recommendations for corrective or preventive treatment. And you'll receive frequent and continous service, too.

Thorough investigation, proper treatment and frequent service have made Drew one of America's fastest growing water treatment companies. Consult the nearest Drew engineer or write for information.

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS

Nationwide Service in Boiler Water and Cooling Water Conditioning

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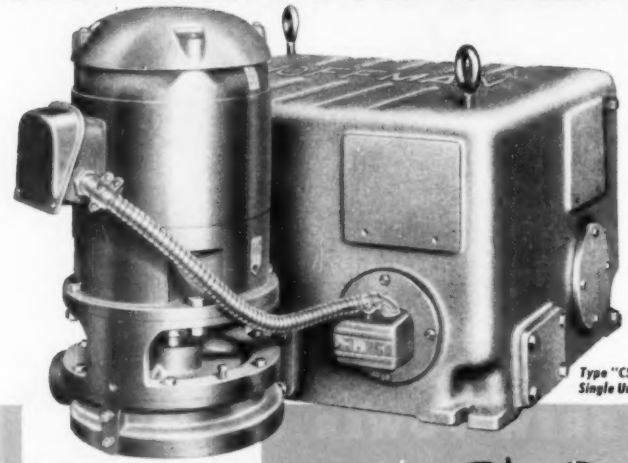
NEW IMPROVED CLOSE-COUPLED CONDENSATION PUMPS



Type "CS" Single Unit

THESE FEATURES ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1. Bronze fitted throughout.
2. Enclosed, precision balanced bronze impeller.
3. Stainless steel impeller hub.
4. Renewable bronze wearing ring.
5. Split bronze packing gland.
6. Drain plug for impeller casing.
7. Standard ball bearing motor, 40°C continuous duty, with ample overload capacity.
8. Heavy cast iron receiver.
9. Heavy duty float control, seamless copper float and brass rod.
10. Impeller has top suction inlet—eliminates air or vapor binding.
11. No piping between pump and receiver.
12. Float switch adjustable to various water levels.
13. Rigid motor support, very quiet.
14. Threaded outlet on pump cover to provide drainage and eliminate base with drip lip.

Hoffman, an old name on pumps, is proud to present a completely NEW line of Close-Coupled Condensation Pumps in single and duplex units!

Type "CD" Duplex Unit

Not only are these compact Hoffman Pumps recognized as highly efficient units, but they have design features which amazingly prolong service life, at low upkeep cost. They are so constructed that all parts subject to wear can be easily renewed. All cast iron and bronze construction.

Series "CS" and "CD" Pump capacities range from 1,000 to 150,000 sq. ft. EDR. Discharge pressures range from 10 lbs. per sq. in. to 60 lbs. per sq. in.

All together, these pumps are a rare combination of sound design and excellent workmanship. Units are shipped ready for connecting to the system.

FOR SMALL SYSTEMS THE "WATCHMAN NO. WC 8-20" PUMP for low pressure heating systems. Rating: 500 to 8000 sq. ft. EDR. Pump Capacity: 12 gallons per min. Pressure: 20 lbs. per sq. in. at pump discharge. ½ HP Standard Nema motors.

HOFFMAN SPECIALTY CO., Dept. P-3, 1001 York St., Indianapolis 7, Ind.
Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.

More TECHNICAL BRIEFS

Begins on page 150

turbine. Stainless steel is now used to a greater extent to resist pitting and corrosion, with a resulting reduction in maintenance costs. Self-lubricating bearings and carbon seal rings have simplified operation and eliminated sources of trouble. The present trend is towards the use of Francis turbines for high heads and towards an increase in the specific speed for given heads. Reversible turbines, which operate in one direction to produce power and in the opposite direction to pump water have shown high model test efficiencies. *ASME paper. No. 51-A-101.*

More POWER NEWS

Begins on page 148

COMING EVENTS

March 10-14—National Assn of Corrosion Engineers, Annual conference, Buccaneer Hotel, Galveston, Texas. A B Campbell, Executive Secy, 919 Milam Bldg, Houston, Texas.

Mar 24-26—American Society of Mechanical Engineers, spring meeting, Univ of Washington, Seattle, Wash. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N.Y.

Mar 25-28—American Power Conference, Hotel Sherman, Chicago, Ill. Meeting chairman, R A Budenholzer, Illinois Institute of Technology, 3300 South Federal St, Chicago, Ill. Exhibit director, A F Thompson, 176 W Adams St, Chicago 3, Ill.

April 7-9—American Society of Lubrication Engineers, seventh annual meeting, Hotel Statler, Cleveland. J L Finkelmann, chairman, Warren Refining and Chemical Co, 750 Prospect Ave, Cleveland 15, Ohio.

April 14-18—Oil Heat Institute of America, 29th Oil Heat Exposition, Exposition Hall, Philadelphia, Pa. R H L Becher, mgr, OHI, 6 East 39th St, New York 16, N. Y.

A P Richards Clapp Lab Prexy

The William F Clapp Laboratories, Inc, Duxbury, Mass., have elected A P Richards president and director, succeeding the late Dr Wm F Clapp who died Dec 28.

The Laboratories, incorporated in 1948, will continue Dr Clapp's lifelong program of extensive research in marine deterioration. He and his staff were recognized as world authorities on destructive marine organisms, principally marine borers. Their records cover the incidence and destructive effects of these organisms throughout the world.

The Laboratories have contributed greatly to prevention of losses from uncontrolled borer attack on waterfront structures, by determining which wood preservatives are most effective and how they should be used.

They are interested in anything concerning activities of micro- and macro-organ-

POWELL VALVES
are engineered to suit
the service conditions
Therefore, when you install the correct Powell Valve in a line, you are assured of long, trouble-free performance under even the most exacting conditions.
And because there's a POWELL valve for every known industrial service, there are more different kinds of Powell Valves in use today than any other make.
The Wm. Powell Company
Cincinnati 22, Ohio
Fig. 1503 W-E 150-pound Cast Steel O. S. & Y. Gate Valve with welding ends
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150
STEEL
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
SINCE 1846

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Get *positive* protection with Strong's Combination Separator and Trap!

Spray guns, air chucks, fixtures and other air-using equipment, *must* be kept free of water and oil for best results. Strong's Combination Separator and Trap will completely separate all liquids from air (or steam) and automatically discharge them.

CHECK THESE FEATURES:

★Highest operating efficiency;
★No cleaning required;
★Copper-clad steel float (stainless steel at additional cost);
★Anum-Metl seat and disc—guaranteed leakproof for one year;
★Sizes from ½ to 1½ inches, screwed; pressures to 250 psi.

Other products in the *complete* STRONG Steam Specialties line include steam traps, strainers, separators, pressure regulators and continuous blow-down valves. For complete information, write for your copy of our new Catalog 68-P today, or see one of our over 200 distributors.

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
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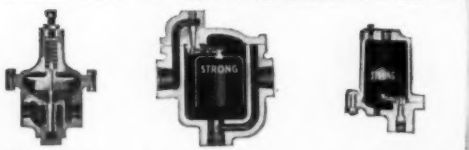
ANUM METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES



Reducing Valve | Inverted Bucket Trap | Air or Vent Trap

STRONG

MORE POWER NEWS

Begins on page 148

isms with respect to structural materials, including biological deterioration like action of bacteria and fungi on cordage and other fibers, saltwater corrosion and protective coatings, and control of fouling of ships and power-plant cooling water tunnels by using anti-fouling compounds and thermal treatments.

Dr Clapp's pioneer work in the field can be expected to continue with no loss of momentum, for Mr Richards had been his principal assistant for the past 16 years and was selected and trained by Dr Clapp to be his successor.

Alcan's Largest Hydroelectric Plant

To serve the world's largest aluminum plant, now being constructed at Kitimat on the Pacific Coast of British Columbia, Canada, the Aluminum Company of Canada (Alcan) is building the third largest hydroelectric plant in the world. It will be several times larger than any other operating under a comparable head of 2500 ft. The units will be next to the largest in the world (150,000 hp); their capacity is exceeded only by the Grand Coulee units on the Columbia River in Washington. These were designed for the same capacity as the Alcan turbines but operate continuously at about 170,000 hp.

A dam on the Nichako River, a tributary of the Fraser, will interconnect a series of lakes forming a large high-level storage reservoir (El 2800 ft) over 100 miles long. Flow from this reservoir will be west (not down the Fraser) through a 25-ft horseshoe-section tunnel, 10 miles long, and 1-mile long penstocks. Power plant is underground, blasted in solid rock near sea level on the Kemano River.

Kaiser Readies Aluminum Plant

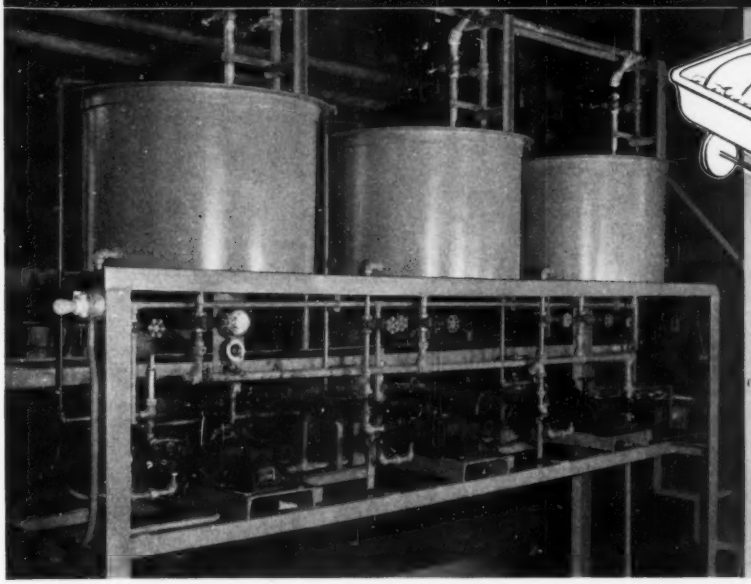
Upon completion in mid-1953, Kaiser Aluminum & Chemical Corp's Chalmette, La., plant is scheduled to produce 400,000,000 lbs a year of primary aluminum. At that time Kaiser's total capacity will be increased 132% over current capacity to 790,000,000 lbs annually, about 28% of the nation's aluminum production.

The plant is part of a general mine-to-metal company expansion program amounting to nearly $200,000,000. Plans include 70% capacity increase of the Baton Rouge, La. alumina plant; increased bauxite production at the ore deposits in Jamaica, British West Indies; and improving existing facilities at the Mead reduction plant, Spokane, Wash., to increase capacity.

The first of the 8 potlines in Louisiana was rushed to completion in record-breaking time after construction began on Feb 20, 1951. Approximately $150,000,000 worth of concrete, steel, aluminum, lumber, other building materials, machinery and labor will be poured into the plant to construct about 75 buildings with 35 acres of floor space and miles of rail tracking and roadways. The completed plant will employ 2,000 persons.

Package for Triplets

WATER FOR TRIPLE BOILERS INDIVIDUALLY TREATED BY SINGLE PACKAGE



Assembly includes 3 Model SHPM Adjust-O-Feeders — Capacity 7.5 GPH against 225 psig — handling phosphate and sulfite solutions.

This %Proportioneers, Inc.% packaged system includes metering pumps, chemical tanks, motor starters, controls, valves, piping, and all auxiliary equipment — compactly arranged as a single unit. Treating chemicals are fed automatically in proportion to service load on each boiler. This "Triplet Package" is supplied complete — a single responsibility for your chemical feeding system. We can also supply systems for treating one, two—or *any* number of boilers: chemical feeding systems for any power plant from the largest high pressure installation to the smallest low pressure job. For recommendations call in % Proportioneers, Inc.%.

Write for Brochure SM 9020
"Treatment of Water for Boilers" and Bulletin CAT.

% PROPORTIONEERS, INC.%

Write to %PROPORTIONEERS, INC.%, 354 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

an ACCO product

RUGGED...

• That's the best way to describe R-P&C Bar Stock Valves. These fine throttling valves provide precise, positive flow control. Long, low-cost, trouble-free service makes them ideal for meter, gauge, test, and general purpose use. Precision turned . . . from carefully tested metals . . . and suitable for a wide range of pressures and temperatures.

See your R-P&C distributor or write the nearest R-P&C district office for information.

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

TRADE MARK

R-P&C valves

BOOKSHELF

Energy Sources—The Wealth of the World *(1952) By Eugene Ayres, Gulf Research & Development Co, and Charles A Scarlott, Editor,* Westinghouse Engineer. *344 pp, illust, tables, $5. McGraw-Hill Book Co, 330 W 42nd St, New York 36.*

Energy is a central fact of life for us as power engineers. We spend our working hours converting it from one form to another, distributing it, and putting it to use in production. Yet, perhaps because of this very familiarity, we rarely pause to take a broad look at energy—its sources, its uses, its fundamental position as one of the great bases of modern civilization. Ayres and Scarlott have taken such a look for us and the highly readable result is a book that should be known to all engineers.

Straight thinking on energy sources starts with a look into the past. For thousands of years, men and animals, wind and water, and wood from the great forests formed the major energy sources. These are alike in that they are replaceable.

About 150 years ago, this pattern began to change. We began to tap energy sources stored away when the earth was young—the "fossil" fuels, of which coal is a prime example. These are not replaceable. So we began living on our capital. This tremendous inheritance of readily obtained and easily converted energy furnished the "muscle" for the vast growth of industry over the past hundred years.

The result, in the countries where these fossil-fuel resources were heavily exploited, was an enormous stride forward in material well-being. It would have been foolish not to spend this energy inheritance from the past, but it would be equally foolish to forget that we can't always live out of capital.

Ayres and Scarlott paint in the historical and factual background needed to fully grasp and understand the basic situation outlined in bald terms above. They show clearly the probable limits of our fossil-fuel supplies. In an unusually complete way, they analyze present and future patterns of energy consumption, possibilities of conversion from one fuel to others (synthetic gasoline from coal, for example) and the wastes (avoidable and unavoidable) involved in fuel use. Equating probable supplies to consumption patterns shows the "life expectancy" of our fossil fuels, and poses the future energy-source problem.

At some time before our fuel inheritance is gone, we'll have to begin large scale use of replaceable energy sources (vegetable growths of all kinds) or of relatively inexhaustible sources such as the winds and solar energy. Ayres and Scarlott explore all the possibilities; bring together from many scattered and inaccessible sources a fascinating array of facts and estimates on energy possibilities of farm products, marine vegetation, solar emanations, wind and tides. Not only do they assess all possible sources, they examine all likely forms of conversion. Even engineers well read in this field will find here new possibilities,

Photos Courtesy The Austin Company
Engineers and Builders

4 UNION BOILERS *at* THE UPJOHN COMPANY

Fine Pharmaceuticals Since 1886

KALAMAZOO 99, MICHIGAN

EACH of these 4 coal fired Union "A" Type Boilers delivers 60,000 lbs. of steam per hour 175 psi—sat., for heat and process requirements at the new Upjohn Plant on Portage Road, Kalamazoo, Michigan. Their design provides for gas or oil firing if necessary. The Upjohn selection charges these Union Boilers with supplying steam for some 33 acres of modern plant under roof, where over 700 world-famous Upjohn pharmaceuticals are produced. Known for fine pharmaceuticals since 1886, Upjohn selects every unit upon which production depends with critical eyes. You can fully depend upon Union to furnish correct steam generating units for your specific requirements. You will profit by consulting with Union engineers.

The Upjohn boiler plant building is designed to accomodate 2 more boilers when needed. The 50 ton per hour coal bunker overhead is designed with weigh-larry to serve boilers on both sides of the boiler room.

UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

We'll Mail You
THIS VALUABLE MAINTENANCE AID
24 PAGES CLEARLY ILLUSTRATED
IS IT WORTH IT?
HERE'S THE STORY OF ELECTRICAL INSULATION RESISTANCE
For Practical Men
This little booklet covers insulation resistance testing in simple language; packed tight with maintenance hints
JAMES G. BIDDLE CO. ELECTRICAL & ELECTRONIC INSTRUMENTS

Booklet on Insulation Resistance Testing Answers these questions:

"What is insulation?"
"What makes it go bad?"
"How to test it?"
"Is testing worthwhile?"

"*For Practical Men*" is packed tight with maintenance hints such as—How to Spot Trouble Fast—The Importance of Keeping Records, etc. Purposely written in non-technical language, this booklet received practically unanimous approval in a recent survey. Respondents claimed it was most helpful to them in their electrical maintenance work. Many requested extra copies to pass along to their associates.

If you haven't sent for your copy—or if you want more copies—we'll gladly fill your request by early mail. Thousands have been distributed.

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Title_____
Company_____
Address_____
City_____ Zone____ State_____

P

More BOOKSHELF

Begins on page 194

new angles on old ones.

A unique final chapter, written by Rolande C Widgery, draws up an energy balance sheet for the United States. Here, in one place, we can see where our energy comes from and how it is used. Useful appendices give (1) key statistics on major fuels and energy uses (2) conversion factors for fuel and power (3) an extensive bibliography.

F A Annett

Practical Industrial Electronics *(1952). By F A Annett, formerly Associate Editor of* POWER. *381 pp, illust, $5.50. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y.*

Here's a book that first saw the light of print in the pages of POWER. It appeared as a series of articles by Associate Editor Fred Annett, starting in April, 1948, ending in Nov, 1951. Readers requested extra copies of the first articles, have plagued Fred with requests for reprints of each article as it appeared. Some wondered if the material would be available in any other form. Just before he retired last August, after 35 years with the POWER staff, Fred delivered the manuscript to McGraw-Hill Book Co. Now anybody who wants the *Electronics for the Power Engineer* articles can have them—in permanent form.

Written for practicing engineers and electricians who install, operate and maintain electronic equipment, this book clarifies electronic behavior by treating the electron as a useful tool, and by describing exactly how the circuits and tubes are applied to equipment. It presents electron flow as the direction of current flow.

The author explains how electron arrangements in atoms cause them to combine chemically, why some gases are inert, why some metals are light-sensitive and others are good conductors. Also why bodies become electrically charged, how a slow drift of electrons in a closed circuit constitutes electric current flow, and how electrons are released from solids in hot-cathode and in light-sensitive tubes. Rectifiers, oscillators, and many electron-tube devices are explained in a clear, easy-to-understand fashion. The book both analyzes electrical fundamentals and circuits and shows how they are applied to relays, smoke indicators, recorders, combustion safeguards, motor-speed controllers, etc.

(*More Bookshelf on page 200*)

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

...to be sure of sound welds and fast assembly

Ⓛ TO MARK PROGRESS

Keeping welding costs down to a minimum and erection schedules on time... these are important advantages you can assure to any piping job by installing Ladish Controlled Quality fittings. Metallurgical controls over materials and methods provide an assurance of uniform weldability in every Ladish fitting... and thorough inspection to rigid standards of physical dimensions and geometric accuracy assures fast piping assembly.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

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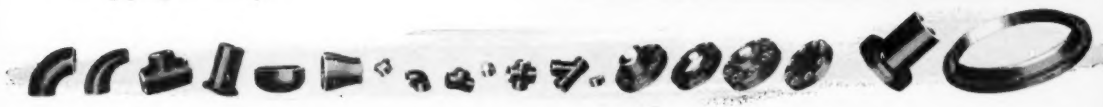


Why the CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

. . . . DOESN'T BECOME GUMMED UP FROM DIRT-SCALE AND VISCOUS MATTER . .

Available in sizes ¼" to 2". Each size with expanded outlet if desired.

● **There are no complicated inside works in the "1000" valve. As a matter of fact there is only the one vital moving part — the seat piston. There are no restricted passages, no small ports, no aggregation of close fits. It's streamlined all of the way.**

The seat piston is opened in a positive manner by the force of the initial pressure and is closed in an equally positive manner by the force exerted by the delivery pressure on the diaphragm. The seat piston is tied to the diaphragm by the rocker arm so that when the diaphragm moves it must move too.

Thus, the positive moving valve arrangement in STREAMLINED housing, with its continuous-duty performance insures against trouble from gumming up, thereby minimizing maintenance.

PERFORMANCE RESULTS FROM *Streamlined Flow*

1. Maximum Capacity when needed most
2. Accurate Pressure Control under toughest working conditions
3. Trouble-free Service
4. Smooth Operation
5. Tight Closure
6. Accurate Regulation
7. Speedier Production Results
8. Elimination of failures
9. Constant Delivery Pressure
10. Cost Saving Operation
11. No Spoilage
12. Practically zero in maintenance costs

Write for Bulletin "1000" which gives details on the performance of this "Streamlined" 1000 valve and its benefits.

How Streamline Design Works

● Flow has been streamlined for straight flow into the delivery passage and jet. See FIG. 1. The fluid

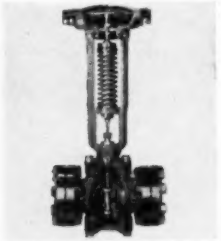
FIG.-1

flows smoothly around this valve with no back eddies to cause turbulence. See FIG. 2, on the downstream side of its trailing edge. In a reducing valve all the pressure drop or work of pressure reduction should occur at one place, namely where the valve throttles flow, and not on the downstream side of the valve. Where you have downstream turbulence, See FIG. 2, the greatest amount of turbulence with resultant greatest pressure drop will occur when you want maximum flow and therefore want least pressure drop—if the delivery pressure is to be maintained. With

FIG.-2

Streamlined Flow, See FIG. 1, you get maximum capacity, plus close delivery pressure control.

OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.

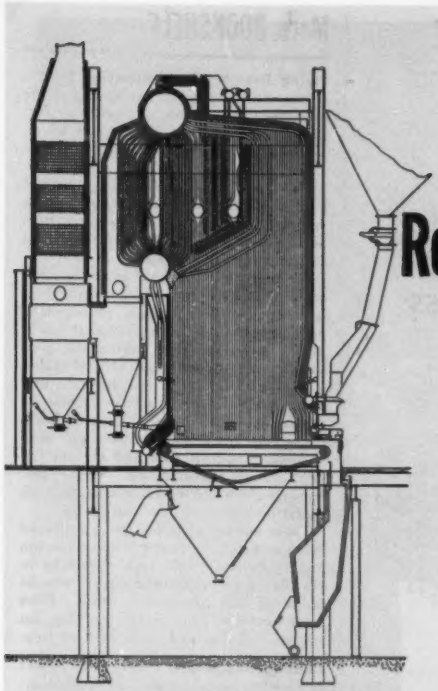
Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump bypass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.

Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.

☆

CASH STANDARD CONTROLS . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

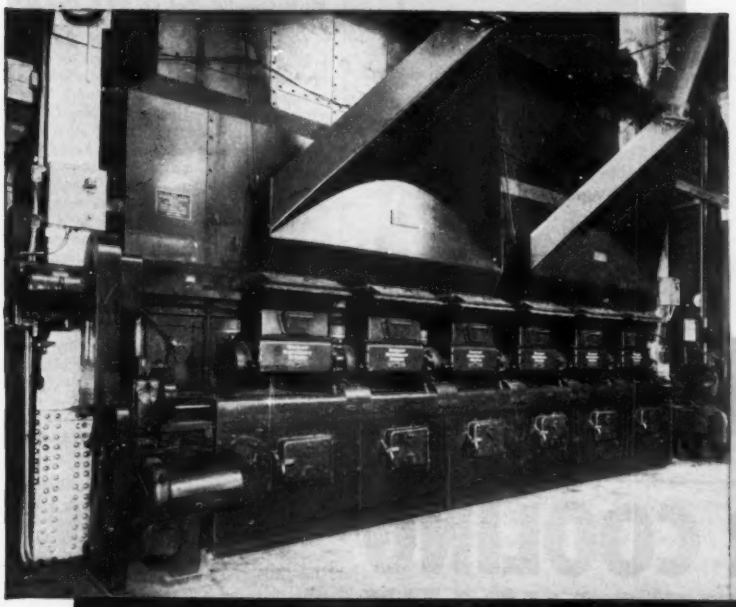


RotoGrates Bought Twice For Erie

General Electric Company twice selected Detroit RotoGrate Stokers for their Erie, Pennsylvania, plant. First Unit —150,000 pounds. Second Unit—175,000 pounds. Both modern installations are with Babcock and Wilcox Steam Generators.

Detroit RotoGrate is an improved spreader stoker in which grates move slowly forward, automatically discharging ash at the front. Economically burns all grades of Bituminous Coal or Lignite. Higher burning rates produce more capacity per foot of furnace width, keeping down investments in both steam generating equipment and building. Thermal efficiency is exceptionally high . . . either with steady or fluctuating loads.

It will pay you to investigate the RotoGrate.



There is a type and size of Detroit Stoker for every Industrial and Power Need

DETROIT SINCE 1894 STOKERS

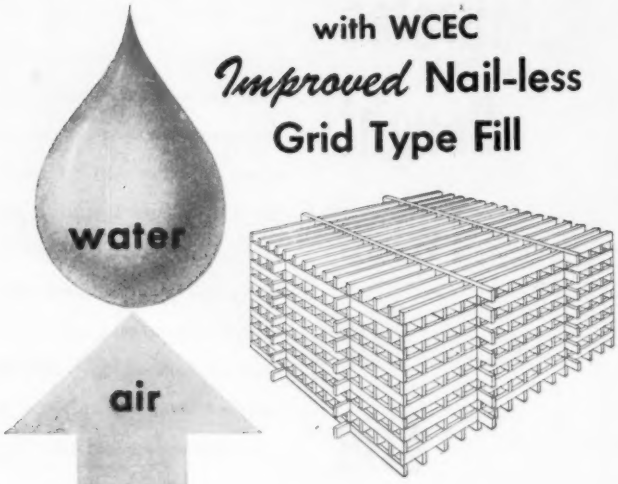
DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities — Works at Monroe, Michigan

most wetted surface . . .

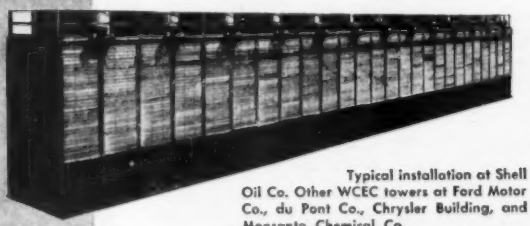
with WCEC *Improved* Nail-less Grid Type Fill



WCEC new improved grid type fill provides more wetted surface and greater retardation of descending water than any other design. The water is repeatedly interrupted and refilmed in its downward passage. The rising air is guided through open lanes in intimate contraflow with the water. This maximum wetted surface and maximum retardation of the water completely utilizes the heat removing capacity of the air with minimum possible air resistance, resulting in highest cooling efficiency. Consider this important feature when you consider the purchase of a cooling tower.

SEE OUR CATALOG IN SWEETS FILE

TOWERS OF STRENGTH WCEC



Typical installation at Shell Oil Co. Other WCEC towers at Ford Motor Co., du Pont Co., Chrysler Building, and Monsanto Chemical Co.

WATER COOLING EQUIPMENT COMPANY

MAIN OFFICE • New Hampshire Ave. and Weber Road • St. Louis 23, Mo.

Fabricating Plants: St. Louis, Mo. • Arcata, Calif. • Houston, Texas

REPRESENTATIVES IN TWENTY-EIGHT PRINCIPAL CITIES

More BOOKSHELF

Begins on page 194

Piping Design and Engineering *(1951). By members of the engineering staff of the Industrial Piping Div, Grinnell Co, Inc, 224 pp, 8¾ x 11¼ in., illust, many tables, cloth. $10. Grinnell Co, Inc, Providence 1, R.I.*

This book contains data and technical information for design of pressure piping systems. Some facts given have not been published before while others were not compiled in a single volume.

Major subjects include expansion and stresses, velocity and pressure drop, heat transfer, allowable stresses, pressure-temperature pipe graphs, metallurgical briefs, piping materials, pipe fabrication, pipe hangers and supports and general tables.

Section on expansion and stresses is particularly useful, giving a large number of tabular solutions for pipe shapes and bends of various types. Single-plane and multiple-plane systems with and without circular arcs are also discussed. Typical problems are given and solved, making the book useful for study and practical design.

Large number of tables give a wealth of information on all phases of piping design and application. This book should be in the library of all piping designers who do industrial and power-plant work. Plant engineers who must design and lay out systems will also find much in it of help.

Heating Design and Practice *By Robert H Emerick, consulting mechanical engineer. 453 pp, illust, tables, 6¼x9¼ in., cloth, $8. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y.*

This is a complete coverage of heating, giving practical methods for design and operation of steam, hot-water and warm-air systems. It is profusely illustrated with everyday problems from actual jobs.

Fully covered are design, application and control of radiant heating and baseboard units, the heat pump, space heaters, fans and filters. Boilers, steam generators, grates, stokers, stacks and chimneys are thoroughly treated. Section on fuels and combustion shows you classifications of various fuels and their relative combustion characteristics.

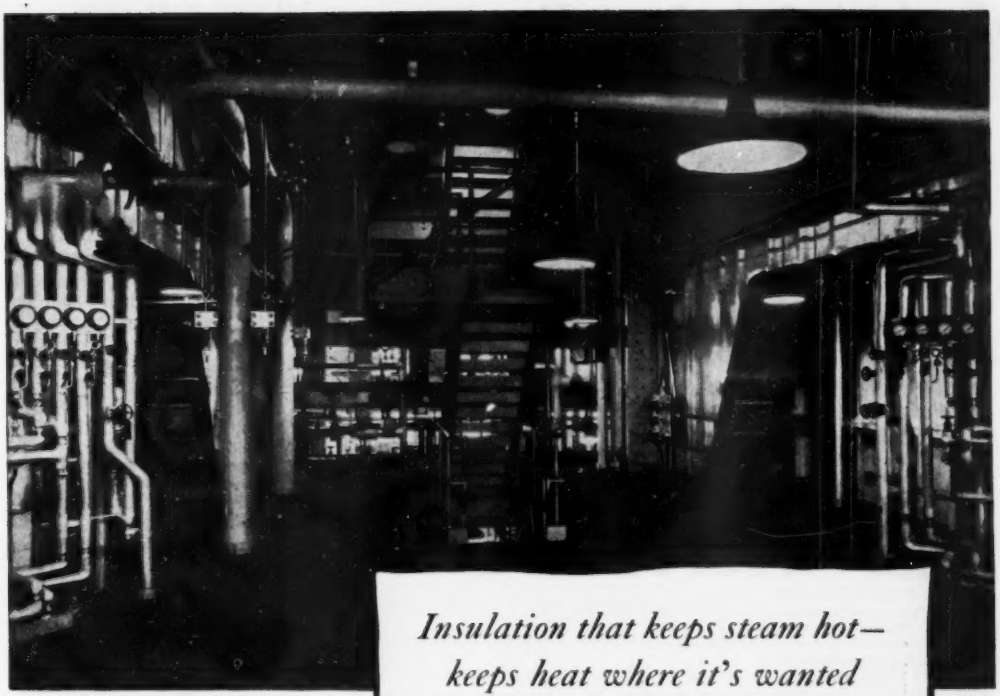
You are shown principles and methods for using the ignition arch, how to size hot-water heaters, facts on motive power and operational characteristics of gravity systems, advantages of mechanical circulation and eight cardinal steps in the design of forced-circulation systems.

The book concludes with a wealth of working facts on how to prepare specifications and make bid analyses.

National Electrical Code Handbook. *(7th edition). By Arthur L Abbott, 5½ x 7½ in., 652 pp, $6. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y.*

This standard handbook tells how to handle all types of wiring jobs in accordance with 1951 edition of the National Electrical Code. It explains the rules for each job, what these rules mean and how to apply.

There's a key on the front cover and flyleaf so you can quickly refer to any part of the book. Slanted for quick reference by busy, practical men.



Large eastern power station:
Piping insulated with "Featherweight" 85% Magnesia, sewed canvas jacket; ducts with 1½" "Featherweight" blocks and ½" thickness of cement.
Insulation Contractor:
Armstrong Cork Company.

Insulation that keeps steam hot—keeps heat where it's wanted

•

"FEATHERWEIGHT"® 85% MAGNESIA

—insulation that delivers more steam at less cost! For more than 60 years "Featherweight" 85% Magnesia Insulation has been known throughout industry for outstanding efficiency in all heating applications up to 600° F. You'll find it in power stations and steamships, in hospitals and food processing plants, in oil refineries and chemical installations—in fact, wherever exacting steam temperature control is a must.

And "Featherweight" 85% Magnesia not only gives you efficiency, but also extreme durability. It is structurally strong; can withstand reasonable amounts of compression, vibration, and contact. Physically inert, "Featherweight" will not spall or crack when subjected to the alternate heating and cooling of steam system start-ups and shut-downs. And, being entirely mineral in nature, it will not burn. In short, it is difficult to overestimate the efficient life of "Featherweight" 85% Magnesia. In most cases, it will outlast the heating system!

Your Keasbey & Mattison Distributor, who is an experienced applicator, will be glad to give you complete information on "Featherweight" 85% Magnesia. Or, write us direct.

K&M best in asbestos®

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

In Canada: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, and VANCOUVER

Hendrick Open Steel Flooring . . .

gives you these outstanding advantages—

90% open area for light and ventilation . . . rectangular, square-edge steel bars that provide a safe, non-slipping, level walking surface . . . pressure-formed Mitco construction that obviates weaknesses of bolts, rivets and angle irons . . . no welds, with liability of residual stresses that lead to warping . . . ample strength to support heavy loads without any lateral deflection of flooring. Write for Hendrick Mitco Products Catalogue.

SEE OUR CATALOG IN SWEET'S

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

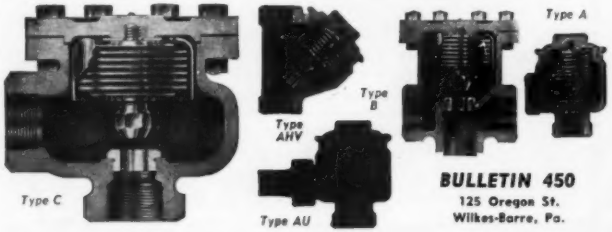
46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Nicholson Traps Help

CUT STEAM COST $500,000 A YEAR

At one of the nation's large processing plants a campaign to promote economical steam use by improving heat transfer efficiency has resulted in a yearly saving of $500,000. Credit for a fair portion of this is given to improved steam trapping, which resulted from the installation of Nicholson thermostatic traps. To see why an increasing number of leading plants are standardizing on Nicholsons for positive drainage and faster heat transfer, send for Bulletin 450.



BULLETIN 450
125 Oregon St.
Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

CATHODIC PROTECTION

Continued from page 73

affecting current density: applied electromotive force, electrode area, active cathode area, mineral content of water, length of path through which current flows.

Deciding the proper current density is difficult. Too high a density brings greater problems than you started with. Too low, and you have no protection. To protect iron, current densities vary from 0.3 to 60 milliamperes per sq ft although it is usually about 2 milliamp. But with iron no damage is likely to occur from too high a current density. Other metals, such as aluminum and zinc, can suffer from this cause. They are called amphoteric because they function both as an acid and a base.

Sudrabin*, an authority in cathodic protection, says higher-current densities are required for water having high electrical resistance, that is, low in solids content. While this seems just opposite to what you'd expect, it is actually because smaller concentrations of insoluble salts form on the metal surface.

Dissolved-oxygen concentrations and flow velocity past the protected surfaces influence current density. The higher each is, the higher the current density. With aluminum and zinc, as mentioned above, too high a current density can cause serious damage. The pH of the film covering the metal surface increases as the hydrogen ion is removed. This creates a preponderance of hydroxyl ions and a migration of cations such as Ca^{++}, Mg^{++} and Na^{+} to the protected cathode surfaces.

Atomic hydrogen must plate out on the cathodic surfaces at least as fast as the rate of reaction between hydrogen on their surfaces and dissolved oxygen diffusing from the main body of the electrolyte to the protected surfaces. Scale, formed on the metal surface before cathodic protection is applied, often loosens and at times breaks off completely under pressure of the hydrogen film building up on the surface.

With a high pH from this film next to the metal, any calcium or magnesium salts present tend to deposit out in this zone. The deposit is chalky and rubs off easily. These deposits prove helpful, particularly if a metal surface, like the inside of a water tank, is alternately submerged and exposed to the atmosphere. In the absence of paint these calcium and magnesium deposits protect the uncovered metal. But they are not as perfect as a coat of paint.

In large diameter standpipes a thin layer of limestone covering the tank bot-

*Lee P Sudrabin, "Cathodic Protection of Steel Surfaces in Contact With Water," *Water Works and Sewerage*, Jan, 1945.

The hard, cold facts about Pittsburgh's hot furnaces!

47 PLANTS OKAY THE HEAT PROVER

Pittsburgh's great steel industry needed an instrument to measure air infiltration, to check air requirement and fuel-air ratio controls in open-hearth furnaces . . . an instrument to check the stoves in which blast-furnace air is heated . . . to check precise atmospheres in soaking pits . . . to control fuel waste and precise atmospheres in processing furnaces.

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1. Rapid continuous sampling.

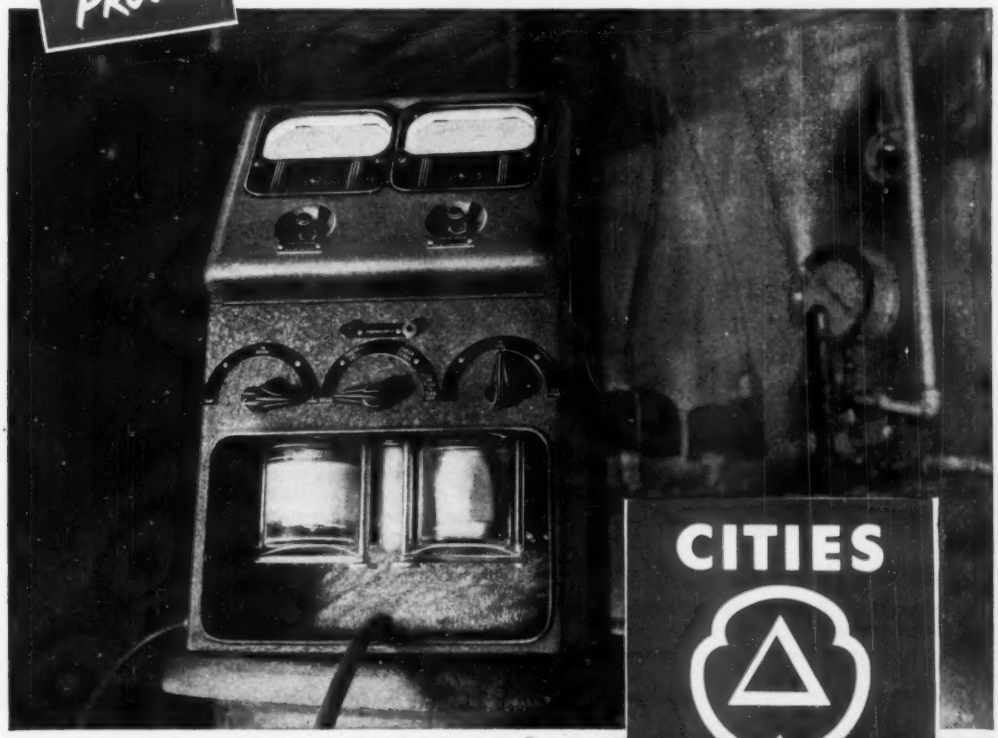
2. Simultaneous reading of oxygen and combustibles.

3. Direct measurement of oxygen and combustibles.

4. Easy portability.

5. No maintenance; no re-calibration.

These points begin to tell you why Cities Service Heat Prover analyses are just as much favored in glass, ceramics, steam generation and other fields as in the great Pittsburgh steel area. For the full story as it applies to you, write CITIES SERVICE OIL COMPANY, Dept. C22, Sixty Wall Tower, New York City 5.



WHY NOT TURBINE DRIVE?

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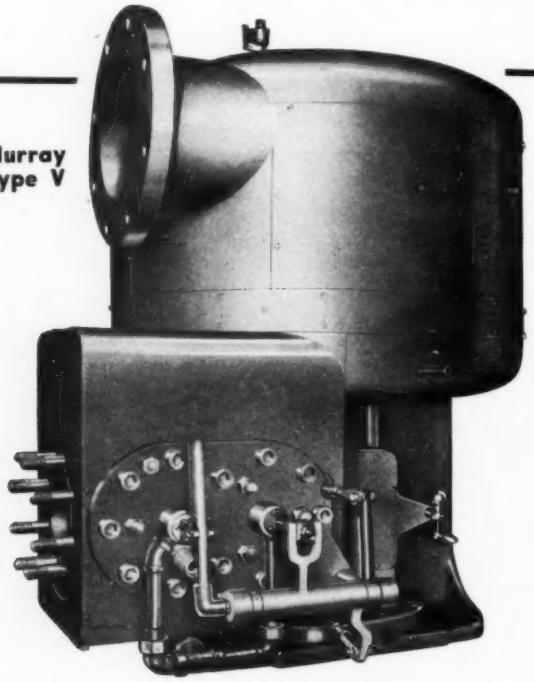
Steam turbines provide safety, low maintenance expense and ability to operate for long periods without inspection. Unsheltered installations are highly practical.

A large selection of types and frame sizes, special features and accessories are available on short delivery to suit your application.



Murray Type V

Among the newest in the Murray turbine line is the Type V vertical turbine, above. This machine provides completely enclosed construction, either direct-connected or geared for vertical pumps up to 600 HP and beyond. See that your new vertical pump is driven with a Type V steam turbine.

Contact your nearest Murray representative or write direct to—

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

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CATHODIC PROTECTION

Continued from page 202

tom tends to reduce over-all current and power requirements, and simplifies electrode design since only the sidewalls require higher current densities.

Precleaning Surfaces. You need not sandblast or wire-brush surface if you plan cathodic protection. Any scale may help because it reduces required current density. Mill scale, though, should come off. By itself it causes no trouble, but as hydrogen plates off the cathodic surface, it will force off this scale. The scale might be carried off into distribution system.

Every so often look to find out how effective your cathodic-protection system is. Areas at some distance from the electrodes need particular attention because they suffer first from too low a current density. A white deposit, mostly calcium carbonate, on the protected surfaces shows the system is working. If the tank holds only condensate or softened water free of calcium or magnesium salts, this deposit won't show up. Any scale that shows signs of loosening up is a sign cathodic protection is under way. It may pay to cut down some on current density if this loosening seems rapid.

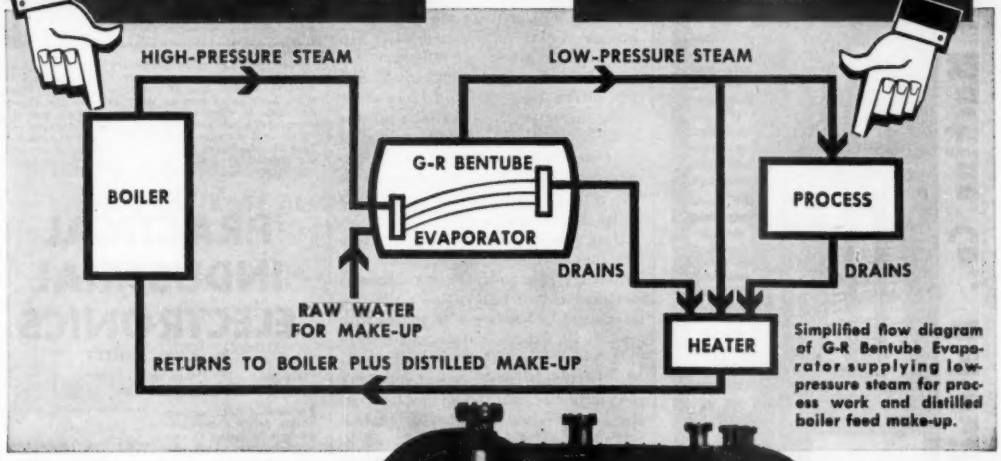
Tubing Protection. Inserting inner tubes or lines of an aluminum-zinc alloy inside standard aluminum tubes makes the liner anodic to the outer tube and gives a galvanic-type cathodic-protection system. What actually happens is that corrosive waters or chemicals pass through inner tube and stay out of contact with outer tube. In time, corrosive action perforates inner tube and permits the solution or electrolyte to touch the outer. Then the anodic relationship of inner to outer takes over and the outer stays protected. This protection holds until as much as 50% of inner tube is dissolved.

Zinc has worked out well for protecting aluminum equipment from cooling-water corrosion. It is usually anodic to aluminum in neutral or slightly acid solutions and, sometimes, weakly alkaline solutions. Aluminum, though, becomes anodic to zinc in strongly alkaline waters. The reason zinc works out despite its position in the electromotive series, Table I, is that aluminum usually coats itself with a protective oxide film. In a highly alkaline water this film is unstable and aluminum remains active so it behaves as you'd expect, Table I. Zinc's protective influence normally extends about 18 in. from the electrode.

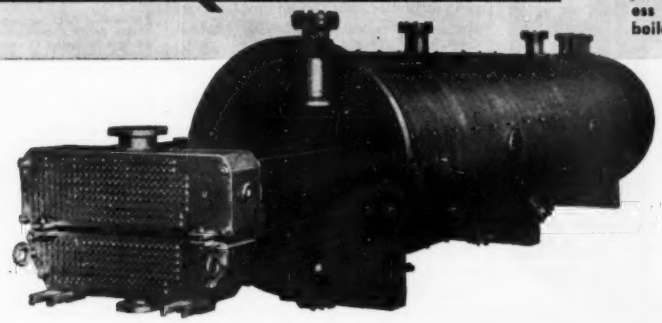
Because aluminum is amphoteric it is safer to protect it with zinc than to use inert anodes and potentials from outside sources. Otherwise, excessive currents would cause high alkalinity in the liquid

with a G-R Bentube Evaporator

PURE WATER for Boiler Feed Make-Up *plus* **STEAM for Process Work**



Simplified flow diagram of G-R Bentube Evaporator supplying low-pressure steam for process work and distilled boiler feed make-up.



This two-in-one unit can double as a 100% thermally efficient reducing valve and raw water purifier. Part of the vapor which it produces can be used as low-pressure steam for process work, while the remainder is condensed as distilled water for boiler feed make-up. The G-R "Reducing Valve" Evaporator wastes no heat . . . requires no chemicals.

For more than 50 years, G-R Evaporators have been proving their effectiveness and economy in marine and stationary installations, large and small. Today, they are in use in power generating stations, industrial and process plants all over the country, as well as on many hundreds of naval and merchant marine vessels . . . wherever pure water is a necessity.

The exclusive features and distinctive advantages of G-R Bentube Evaporators include their famous scale-shedding Bentube elements, design provisions for pure vapor, thorough drainage and easy accessibility.

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GR-263

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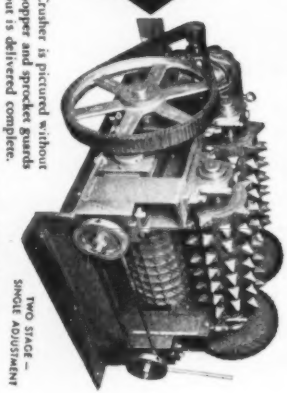
Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)



Crusher is pictured without hopper and sprocket guards but is delivered complete.

TWO STAGE — SINGLE ADJUSTMENT

T. J. GUNDLACH Machine Co., Belleville, Ill. WRITE TODAY FOR CRUSHER BULLETIN P-1

CATHODIC PROTECTION

Continued from page 204

film adjacent to the metal surface, thus endangering it.

Pipeline Protection. Underground pipelines, like the Big Inch, are enjoying extensive inhibition against corrosion by cathodic protection. When galvanic currents do the work, zinc, aluminum and magnesium anodes serve. For any particular installation, factors of soil conductivity, anode location, current density have to be considered. Fig. 4 shows a sample system using galvanic action.

Aluminum electrodes are buried in a mixture of clay and common salt. The salt reduces electrical resistance not only of the backfill but also of the film next to the metal surface. Lime sometimes increases the alkalinity of the backfill, raising the anodic potential of the metal and the solubility of the corrosion products. Aluminum alloyed with 5% zinc also performs well as electrodes for this service.

If an external dc supply system protects underground pipelines, certain conditions must be met: (1) A continuous electrical circuit has to be established throughout by bonding with copper wire around all flanges, valves and fittings (bonding not needed for welded pipe). (2) To reduce power requirements a good insulation coat should develop high electrical resistance between ground and pipeline. Asbestos felt, dipped in hot asphalt and carefully wrapped around pipe, fittings and valves, does a good insulating job, photo, p 71. (3) All auxiliary lines not to be protected should be joined to the main pipe through insulated connections only.

The bonded and insulated pipeline connects to negative side of the dc supply. Positive side goes to the scrap pipe or metal buried in the soil. Enough metal goes into the anode to provide ample area for electrical contact with the soil and wastage to cover a 2-year operating period. Fig. 3 gives a hookup for this type system.

Current from a single rectifier station can protect pipeline sections, 5 to 10 miles long. Distance between these stations depends on electrical resistance of the pipeline to ground and the current required to protect the most remote parts. Potentials at the pipe of about –0.85 v referred to a copper sulfate electrode in the earth are ample. A McCollum earth-current voltmeter gives accurate enough readings. To protect parallel pipelines in the same trench, electrical bonds have to be put in frequently betweeen the two lines so their potential stays the same.

Present Developments. While cathodic protection is still pretty much the province of the specialists a number of

Basic industrial electronics...

made plain for those who INSTALL, USE, and MAINTAIN control devices

Now you can understand the many electronic devices being used so widely in power and industrial plants—and do practical work with them. This book gives you in ABC fashion the fundamentals of electronics. It also shows you the complete breakdown of each kind of device—the tubes and circuits used, and how it functions—just the material you need to hook up controls for particular jobs, see that they operate right, and keep them in good shape.

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By F. A. ANNETT
Associate Editor, *Power*
381 pages, 369 illus., $5.50

IN down-to-earth language this practical book describes such devices as electronic heating system controls, automatic electronic combustion control, magnetic drive-speed control. It shows you how motor generator exciters work—explains the function of liquid level and pump controls. It clearly discusses the application, circuits, and operation of rectifiers, relays, oscillators, smoke indicators, and recorders, combustion safeguards, motor-speed controllers, etc.

Electrical fundamentals and elementary circuits are covered in separate chapters. With these, and the plainly-explanatory treatment throughout, the book makes electronics a simple, useful thing instead of a mystery.

This volume grew from a series of widely-acclaimed articles first published in **Power**. As presented here, the treatment grounds you in needed fundamentals—provides aid in working with electronic devices being more and more encountered in industry.

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9. Time-delay Electronic Relays
10. One-, Two-, and Three-stage Amplifiers
11. Voltage-regulating devices
12. Electronic Oscillators
13. Photoelectric Devices
14. Smoke Indicators and Recorders
15. Combustion Safeguards
16. Automatic Combustion Control
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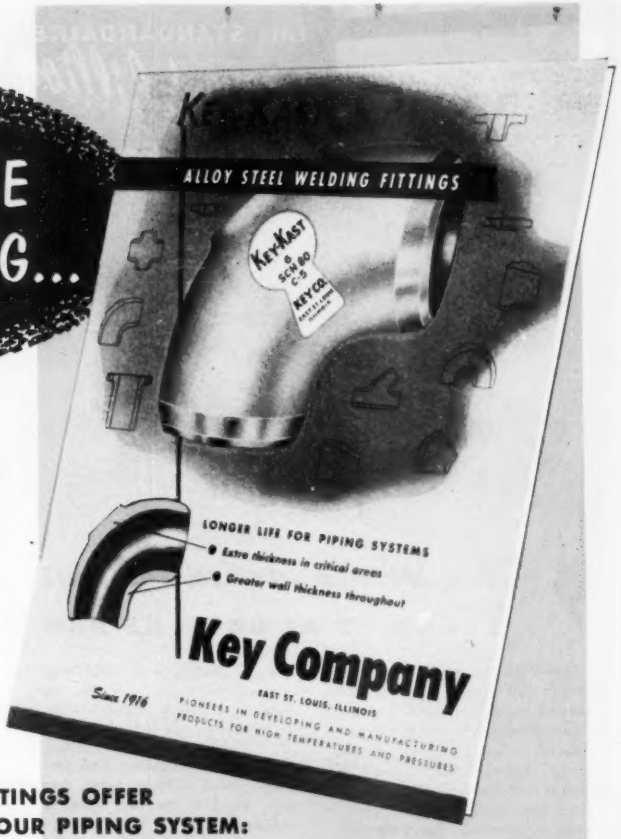
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CATHODIC PROTECTION

Continued from page 206

processes are emerging—many of them patented for miscellaneous equipment. Below are a few of the more extensively developed ones.

Cumberland process, developed in England and extensively studied by the British and French Admiralties, was applied to condensers, boilers, miscellaneous power-plant equipment. It works with 6- to 10-v dc, supplied to iron electrodes, suspended in water in the vessel to be protected. For condensers the iron anodes, supported by steel studs and insulated from the condenser shell, connect through an adjustable resistance and 2-way switch to the position terminal of a dc generator. The condenser shell serves as the negative line terminal. Current path is from electrodes through the water to the condenser shell and back to the generator. Current density runs 2 milliamp per sq ft in extreme condenser cases, as high as 3.3 for l-p boilers with this system.

A second system, the Kirkaldy, supplies low-voltage dc from an external source to anodes immersed in water. These anodes, whether in a boiler or a condenser, are properly insulated. Water acts as an electrolyte, with the boiler or metal surface becoming the cathode. As current flows the scale-forming solids pass to the anode. Current density is small but with proper control the system is effective. Fig. 2 is a characteristic installation. An adjustable resistance on the external-current supply circuit controls current density.

Still another system, the Gunderson, passes low-voltage dc to a boiler water treated with an arsenic salt. This metallic salt is the only major difference from the Cumberland system. Its inventor claims this salt overcomes many difficulties developing with other electric polarization systems.

Briefly, the system consists of two insulated electrodes in the boiler shell, one in the upper part and one in the lower. The conducting members connect rigidly to a duriron anode extending the entire length of the boiler and submerged in the boiler water. This anode is securely attached by insulating clamps to the shell. Insulated wires connect to the electrodes and the dc generator through suitable fuses and resistances so the circuit carries two volts and two to three amperes to each electrode. Current flows from anode to boiler water, then back to the boiler metal and to the negative pole of the generator. Sodium arsenate or arsenic peroxide is added once or twice a week at the rate of 3 lb per 1000 gal water.

The inventor claims that the soluble arsenic plates out on boiler sheets.

Low Maintenance Costs are Assured with S-E-Co. Coal Scales

S-E-Co. Coal Scales assure low maintenance costs because of the rugged construction used throughout. For example, the gear box is a separate, especially designed box for coal scale operation. The electric counter eliminates many small linkages and several adjustments. Electrical equipment is all wired to terminal blocks, simplifying servicing.

A large assembly door and a feeder access door make it possible to remove the feeder and weigh hopper quickly as units. If the feeder support rolls are also removed, the entire inside of the body is free of operating parts. The inside of the scale is then clear for cleaning and painting. If this work is done occasionally, the scale body should last indefinitely.

This subassembly idea has been developed in **S-E-Co.** Coal Scales in order to assure users of the very minimum of maintenance costs.

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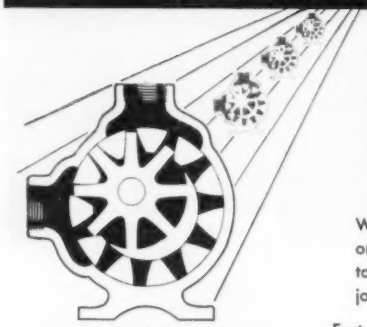

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Viking PUMP COMPANY
Cedar Falls, Iowa

MARMADUKE

Continued from page 142

cle Rumsey told me it was common to see the boiler's sides pant as the throttle was closed or opened. Wow! To make the engineer's life still more interesting, few boilers had a steam gage even as late as 1850. They went by the sound of the exhaust, the way the engine worked, or the appearance and sound of steam blowing from the try cocks.

"Gage glasses didn't come into common use before 1850 either. Before that, only way to tell water level was by opening the try cocks. Or if the water got too high, water in the pounding engine gave a warning. If it got too low, a fusible plug let go. In either case, a cylinder head might blow out or the boiler get damaged.

"On early upright engines the feed pump was run from the engine beam. On later horizontal engines it took its motion from the crosshead. That gave the engineers a headache because the boilers were not fed unless the engine turned. Unless fires were dampened well during the numerous stops, water would get low as the steam pressure went up.

"One solution was to keep the paddle wheel turning slowly, while the boat was tied up. Trouble was, the boilers put out more steam than water returned. At such times the boat was tied up securely, the paddle wheel disconnected, and the engine run fast to fill boilers.

"Later, the 'doctor' came to the rescue. That was a combination feed-, fire- and bilge pump with its own small engine.

"In the early days the muddy river water didn't help the boilers either. It was common to clean boilers every few days in the spring when the river was a pea soup of mud. Later a bottom-blow valve installed on each boiler eased that problem some. Much later a surfaceblow valve helped blow the grease and lighter stuff out of the boilers before it was weighted down by solids and settled on the heating surfaces.

"The boilers in that period were known as the tubular type. They were from 36 to 42 inches in diameter and from 24 to 30 feet long. They had two to seven flues running through them. A firebox was under one end of the boiler and the fire, soot and smoke passed under the boiler shell and back through the flues and up the breeching to the double stacks.

"Steam pressures reached 200 psi by 1850. But when the Steamboat Inspection Service was formed in 1852 to cut down costly accidents and loss of life, they cut pressures to 150 psi.

"The engine had a long horizontal cylinder of 24- to 36-inches diameter with an 8-foot stroke. The long connect-

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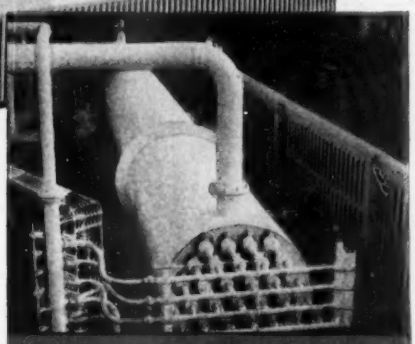
Fluor Cooling Tower Testing Facilities. This commercial-size installation consists of a pump house, instrument house, 20,000,000 BTU/H boiler, test basin, and a 40' high test tower.



This specially designed Dutch Marine-Type Boiler provides varying heat loads to the test tower. Fired by 37 hydraulically-controlled burners operating on either natural gas or propane, this boiler delivers a maximum heat load of 20,000,000 BTU/H.

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A Fluor Cooling Tower recommendation means that all variables are included and compensated for. It means that all component parts, as well as all design theory, have been tested and evaluated under actual operating conditions. And, it means that a Fluor-designed cooling tower will perform at *rated* heat transfer efficiency under the conditions of installed operation. *You can be sure with Fluor!*

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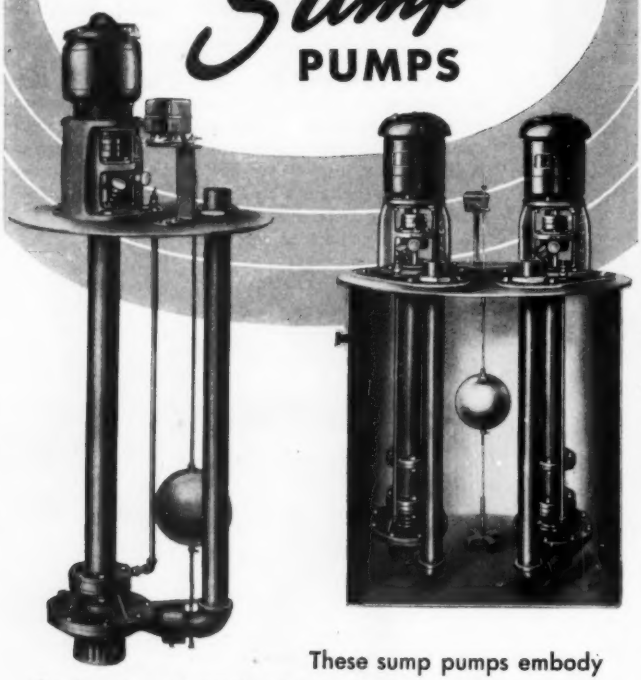


These sump pumps embody the latest and most modern developments such as:

- Positive alignment of all rotating and guide bearing parts
- Flanged column pipe connections
- Motor mounting for standard NEMA type "C" flange
- Adjustable semi-open type impeller
- Heavy duty construction
- Discharge sizes 1 to 10 in. pipe
- Capacities up to 3000 G.P.M.
- Discharge heads up to 140 feet
- Lengths up to 21 feet
- Motor horsepower up to 75 HP.

Send for DEMING SUMP PUMP Bulletin

THE DEMING COMPANY
547 Broadway, Salem, Ohio

Send copy of illustrated Bulletin No. 4600-A on Deming Sump Pumps.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MARMADUKE

Continued from page 210

ing rod cranked away at 20 revolutions. Each side-wheel had one engine. Paddle wheels had one engine cranking away at each side.

"Wood was burned in the boilers and larger boats burned from 50 to 70 cords a day. Boats fueled at the nearest wood yard along the river whenever their supply got low. That was at least once a day. This fuel varied from pine knots to cottonwood and from green timber and rotten driftwood to well-seasoned cordwood. Yet the engineer had to keep plant steam up and make speed besides.

"In that kind of setup life was raw and tough. A good engineer had to be two-fisted to keep things going. Grog was served aboard for the crew so they could stand up under the punishment. There were plenty of fights.

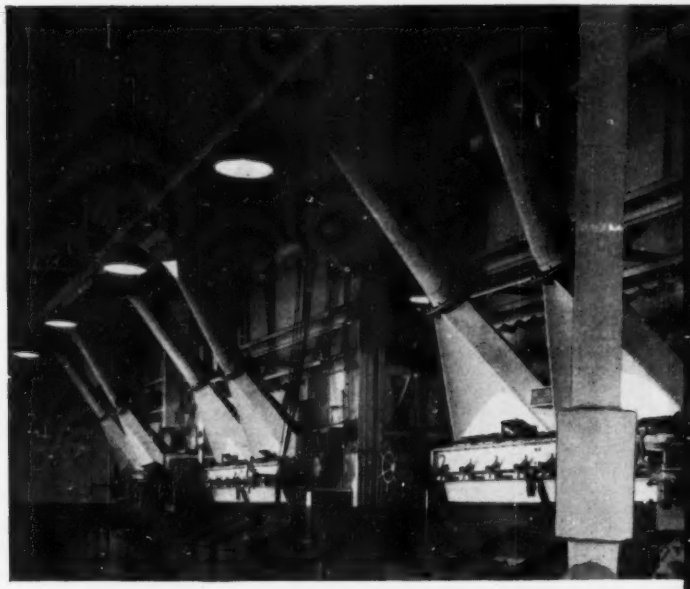
"Not only the crew, but the officers were usually a tough lot. Uncle Rumsey told me that one day a woman passenger ran up to the wheelhouse of the *Grand Turk* and told the captain that a deck hand had fallen overboard. The skipper answered, 'I'm not missing nobody,' and kept his boat headed south. Deck and engine hands were a dime a dozen anyway.

"There was plenty of dirty work between officers of rival lines. And my uncle was as 'hot' and tough as most engineers.

"Mike Fink, chief of the *Lizzie Gill*, was a roughneck. Mike played dirty pool and hit below the belt. When a fireman refused to crawl inside a hot boiler, Mike fractured his jaw with a billet of wood. Another time he socked a fireman with a hammer because he didn't move fast enough. More than one of his crew were said to end up over the side on a dark night.

"Mike and Uncle Rumsey tangled more than once and their boats were rivals too. They would race from landing to landing, trying to get business away from each other. There were no holds barred during those races after the Civil War because the railroads were coming and steamboats were being squeezed plenty. So each boat tried to do anything to get publicity and divert business away from the railroads and the other boats.

"Before Mike Fink got too old to steamboat any more he must of slipped a few cogs. During one trip of nip and tuck between the *Grand Turk* and the *Lizzie Gill*, the *Turk* pulled in to each landing just enough ahead of the *Gill* to grab the cream of the dwindling passenger and cargo crop. Down at Paducah, Uncle Rumsey got word that Mike had loaded one of the *Turk's* firemen with booze in a River Street dive



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and bribed him to pour sand in the *Turk's* main bearings.

"Uncle Rumsey cleared the deck for action. He would give Mike a hotfoot he'd never forget. His boat pulled into the next wood yard a few hours ahead of Mike's boat. That gave him time to bore a few holes in firewood to be loaded on the *Gill*. Then he placed gunpowder in each hole and plugged them.

"The *Lizzie Gill* wasn't much competition the rest of that trip. By the time Mike and his gang got things under control, each time a log blew out a furnace, another would let go. What with fighting fire and cutting out boilers, Mike's boat was delayed for days."

Marmaduke stopped talking suddenly. He clenched his enormous fists and let out one terrific yawn. Next he removed the cork from his bottle of Sandpaper Gin, worked up a 28.4-inch vacuum and ballasted his tanks. Then he roared, "Life was tough on the river and you either held your own with the crude machinery and rough characters, or you didn't last long. And if it wasn't for those river engineers taking the bumps, some of you guys wouldn't have buttons to push today. Remember that."

WITH OUR READERS

Continued from page 5

lettering are essential to topnotch presentation of engineering information, we thought you'd like to know not only the answer to our consulting friends' question but also a little bit of how we go about preparing drawings for publication.

Even the best engineering drawings are rarely suitable for direct magazine reproduction. They contain too many details, have lines that are too fine to stand the reduction necessary to fit them to the printed page. And the lettering is invariably too small to be legible after reduction. So virtually all illustrations used in POWER are redrawn in our drafting dept.

But the job begins on the editor's desk. Knowing what the finished illustration should show, he "edits" the original drawing—eliminates unnecessary lines and confusing details, indicates arrows and legends to be added to speed comprehension. Only then does the drawing go to the draftsman.

He makes the new drawing two to four times larger than the printed size of the illustration. Weight of lines and size of lettering are adjusted to suit the reduction selected. Letterers working on POWER drawings use mechanical guide devices in nearly all cases, for maximum uniformity and legibility. Freehand lettering is employed only when its flexibility is helpful.

Finished drawings wind up where they started—on the editor's desk. He does a careful checking job, may suggest changes to improve appearance and clarity. When the drawing finally gets his OK, it's ready to go to the engraver, first step in the mechanical process that ends in the finished illustration on the printed page.—*Ed.*

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ATOM-IC
EXPLOSION
Just 1/32" (pinhole size) faucet leak
MUSHROOMS into ATOMIC WASTE
of approximately 95,000 gallons
of water yearly—costing:
$24.14
@ $1.90 per M cubic foot
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$88.91 if coal (8819 lbs.)
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Above figures authenticated by Hackensack Water Co. and American Gas Association.
STOP this needless WASTE during today's MATERIAL and MANPOWER shortages with "SEXAUER" "Easy-Tites" that outwear ordinary faucet washers 6-to-1, thus SAVING labor on 5 REPEAT repairs, PLUS water and fuel, while prolonging the life of SCARCE fixtures.
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"EASY-TITE"
FAUCET WASHERS
...a modern laboratory triumph, are compounded from du PONT NEOPRENE (tested up to 300°F.) instead of rubber—to withstand DESTRUCTIVE HEAT common in present-day superheating water systems—that formerly broke down washer's structure.
Built like a tire with fabric re-inforcement they resist the grinding, closing squeeze that SPLIT and MUSH ordinary washers out of shape... causing LEAKS.
Through combining NEOPRENE and FABRIC RE-INFORCEMENT they OUTWEAR ordinary washers 6-to-1 on hot or cold FAUCETS—thus you slash water, fuel and labor costs.
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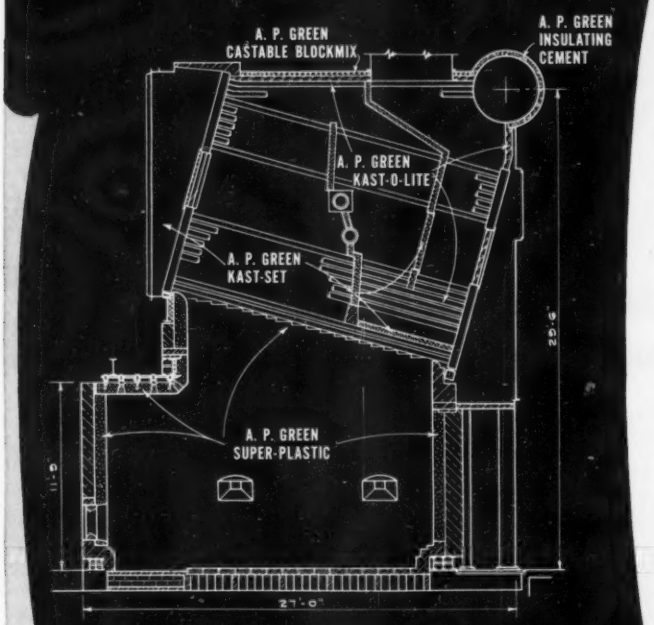
Proven Outstanding Performance

Leads Major Oil Refinery to Use

A. P. GREEN Refractories

for Resetting 12 Water Tube Boilers



One of the country's leading oil refining companies is using A. P. Green refractories and insulating materials exclusively in resetting 12 water tube boilers. This tremendous job requires over 1200 tons of plastic firebrick, refractory and insulating castables and firebrick as shown by the drawing. All 12 of the water tube boilers are of the same size.

Previous experience with A. P. Green refractories and service is responsible for such confidence in A. P. Green Fire Brick Company — it is shared by outstanding companies the world over.

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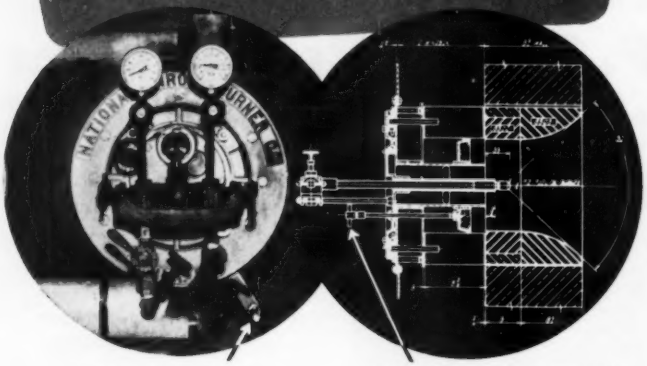

(1) Control For Air Vane (2) Control For Refractory Faced Disk

with

NATIONAL AIROIL Universal Registers

. . . and *economy* means that you get *better performance* with NATIONAL AIROIL Universal Registers because they have a *dual feature* for controlling air volume independent of turbulence. Air vanes can be instantly reversed to change direction of turbulence while air volume is separately regulated by a refractory faced disk control. Both adjustments can be made while the burner is firing.

Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

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OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes: STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

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Industrial Oil Burners, Gas Burners, Furnace Equipment

My Biggest Boner

► ABOUT TWO YEARS AGO I had to put new liners in a 6x4x6-in. boiler feed pump. A friend of mine told me to do the job myself and save the boss $25. I knew the boss would like the saving so I turned to.

Neither liner would go in easily and after much sweating I borrowed a screw jack from the plant across the street. With it we pushed one liner in. But the second stuck and wouldn't budge.

I told the fireman to get a 4-ft crow bar to use instead of the short jack handle. We got the liner in alright but when I tried to screw the jack down the threads were stuck fast.

We figured the threads had been stretched, but to be sure I took the jack to our machine shop. Sure enough, that was what had happened.

Not only that, the lift screw was bowed slightly. The jack was so badly damaged there was no hope of repairing it in the machine shop. The boys sure gave me a laugh as I walked out.

I was plenty red while telling the boss I needed some dough to buy a new jack for the guy across the street. So red that I don't think I'll ever use a crow bar or pipe to extend any kind of handle—jack, wrench or bar.

GEORGE MARSTON
Boston, Mass.

● What is your "biggest boner"? We'll pay ten dollars for each one we publish.

"You may have to stand outside!"

REMEMBER Aesop's fable of the camel and his master--how the kind master allowed the shivering beast to put into the tent first his head, next his shoulders, then his forelegs!

And then the camel said, "Master, I think I ought to come wholly inside," and crowded in. Immediately he said, "There is hardly room for us both, so I think it would be better for you to stand outside so I can turn around and lie down." And without further ado, the camel kicked the man out and took the entire tent.

Men have heard this story for 2,500 years--repeatedly have seen how it illustrates what happens when one man or group of men gain power over others. Men saw it happen in Italy and Germany when Mussolini and Hitler took over. Men saw it happen in Russia.

Even here in America a similar trend is evident. Powerful influences overlook no opportunity, through political manipulation, central controls and bureaucratic regulations, to intrude more and more in our private lives. The situation demands continual, alert watchfulness by all citizens who believe in individual liberty and freedom, to prevent this camel of big government from creeping further into the tent. Before we realize it, "we, the people," the master, may find ourselves "standing outside." In America it is government, which is the servant of the people.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

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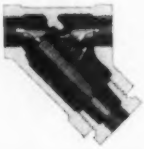
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Clark CONTROLS
CAN SAVE YOU MONEY
All Down the Line!

If dollars are running through your steam lines it's time Clark Controls took over. Water in steam lines wastes fuel, cuts efficiency and adds greatly to maintenance costs.

Clark Steam Traps, with Duo-Stop Leverage, drain *twice* the condensate of ordinary traps. Clark Controls on your lines is truly like money in the bank. Write us for full details.



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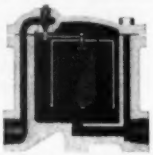
Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" P.S.I.

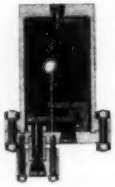


SERIES "70" Inverted Bucket Trap

One of the most popular in the Clark line. Continuous flow capacities up to 2600 lbs. per hour. Sizes ½", ¾" and 1". Pressures up to 200 P.S.I.

SERIES "60" Inverted Bucket Trap

Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-loy" guided disc and seat.



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For continuous flow drainage. Pressures up to 600 P.S.I. Sizes ½" to 2". External discharge valve; "Clark-loy" disc and seat.

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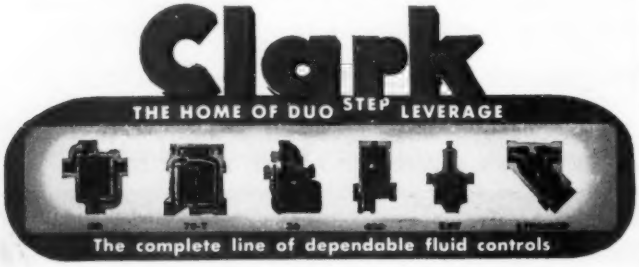


More FREE BULLETINS

Begins on page 163

B14 **REGULATING VALVES** — Automatic, pilot-operated units. 4-page bulletin 700 gives design advantages, has cutaway illustration. Spence Engineering Co, Inc, Walden, N. Y.

ELECTRICAL EQUIPMENT

B15 **MOTORS**—Heavy-duty polyphase and single phase, 1/20 to 5 hp. 8-page catalog shows complete line, specifications, dimensions. Triad Engineering Corp, 450 E Ohio St, Chicago 11, Ill.

B16 **DISCONNECT SWITCHES**—Hook operated, for outdoor service. 6-page bulletin 5104 shows construction features, lists specifications, dimensions; ratings to 161 kv, 600 and 1200 amps. Delta-Star Electric Co, 2437 Fulton St, Chicago 12, Ill.

B17 **TRANSFORMERS** — Proposed AIEE guide for use of openly ventilated dry-type transformers with Class H insulation. 8-page bulletin 61X7088B gives recommendaitons on installation, inspection, operation, for ratings above 50 kva, 600 v. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

B18 **CAPACITORS** — For service replacement. 28-page comprehensive catalog 200C gives dimensions, capacities, prices for tubular, electrolytic, paper, ceramic, etc capacitors. Cornell-Dubilier Electric Corp, Jobber Div, South Plainfield, N. J.

B19 **GROUNDING SHEATH CONNECTORS** — For shielded cables 2-piece compression type connector. 4-page data sheet S5 gives technical information, methods of installation. Thomas & Betts Co, Inc, 46A Butler St, Elizabeth, N. J.

B20 **LAMPS** — Fluorescent mercury type, for large area lighting. 400 w rating, with 4000 hr rated average life. 4-page bulletin A-6007 gives uses, specifications, coefficients of utilization. Westinghouse Electric Corp, Lamp Div, Bloomfield, N. J.

B21 **LIGHTING BULLETINS**—*See Better—Work Better.* 5 bulletins give graphic illustrations of benefits of adequate lighting in industrial installations. Photos, suggestions on lighting patterns, requirements for plant uses. General Electric Co, Lamp Div, Nela Park, Cleveland 12, Ohio

B22 **ELECTRIC INSULATION** — Varnishes, Glyptal alkyd resin, varnished cloths, sealing and filling compounds, silicones. 8-page bulletin CDL-35 has properties, applications, photos. General Electric Co, Chemical Div, Pittsfield, Mass.

B23 **ELECTRONIC TUBES** — For industrial and special purposes. Standard name brands. 28-page catalog EB lists specifications, prices. Milo Radio and Electronics Corp, 200 Greenwich St, New York 7, N. Y.

B24 **FUSES** — Plug, renewable, and one-time types. Also lubricating devices. Condensed catalog broadside FLB 300-C has photos, descriptions. Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis.

B25 **AUTOMATIC CHARGERS** — For industrial trucks. Correct voltage from no load to full load, automatic shut-off when battery is charged. 6-page folder J-4594 gives features, theory, installation photos. Motor Generator Corp, DM-909, Troy, Ohio

HEAT EXCHANGERS

B26 **CASCADE COOLERS**—*Pyrex* glass heat exchange tubes provide high corrosion resistance. 12-page bulletin PE-8 has photos, construction features, nomographs for calculating heat transfer requirements. Technical Products Div, Corning Glass Works, Corning, N. Y.

B27 **FUEL OIL HEATERS**—Oil tank suction heaters. Steam type for heavy grades of fuel oil. Automatic temperature control. 6-page bulletin

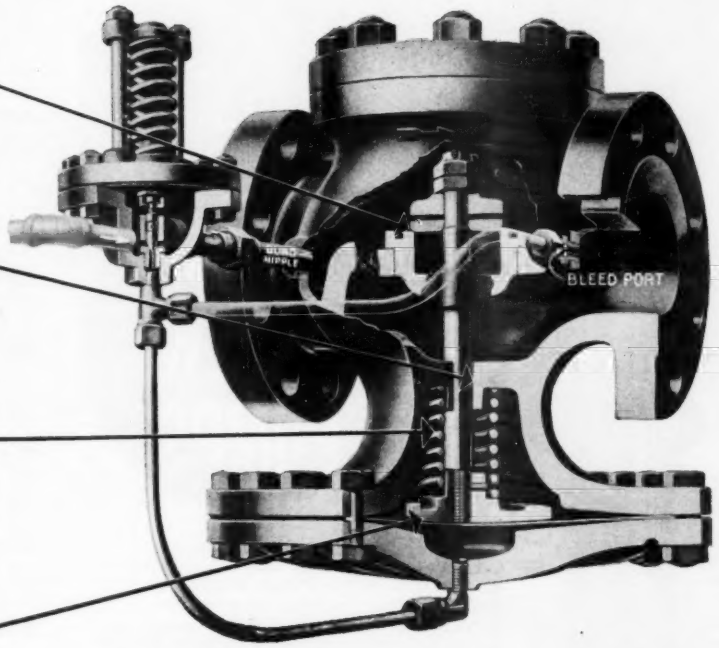
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

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ACCURACY — You can be sure of accurate control for the life of the regulator.

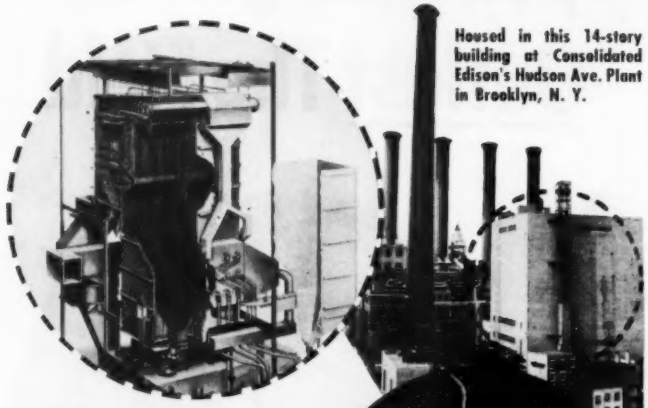
MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

BP-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

The WORLD'S LARGEST BOILER..



Housed in this 14-story building at Consolidated Edison's Hudson Ave. Plant in Brooklyn, N. Y.

..DEPENDS ON Sier-Bath SCREW PUMPS

LEFT—being readied for shipment: one of the six Sier-Bath Screw Pumps selected by Consolidated Edison for vital burner service in the Hudson Avenue Plant installation. As the pumps had to be installed completely *submerged* (making repairs and servicing difficult and costly), prime factors in their choice were *dependability* and *low maintenance needs*. The following features give these qualities to Sier-Bath Screw Pumps:

- **No Metallic Contact Between Rotors**—sustains high volumetric efficiency.
- **High Volumetric Efficiency**—reduces wear caused by erosion.
- **Low Pressure on Stuffing Boxes**—reduces leakage, adds to packing life.
- **Long, Trouble-Free Life**—husky shafts, rotors—high load capacity bearings, deep stuffing boxes.
- **Self Priming • Pulseless Discharge • Direct-connected up to 1800 RPM.**

Models for 1-700 GPM, discharge 1000 PSI for viscous liquids, 500 PSI for water. Available in horizontal or vertical construction, corrosion resistant alloys. Special bodies, stuffing boxes and bearings for high temperature applications.

WRITE FOR BULLETIN

Sier-Bath GEAR and PUMP CO., Inc.

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Founded 1909 Member A.G.M.A.

Also Manufacturers of Gearex Pumps, Gear Couplings, and Precision Gears

More FREE BULLETINS

Begins on page 163

714 shows construction, dimensions, capacities, photos. Hauck Mfg Co, 124 Tenth St, Brooklyn 15, N. Y.

INSULATION, HEAT, COLD AND VIBRATION

B28 **HEAT INSULATION** — For temperatures to 1200 F; for tubes and pipes from ¼ to 72-in. dia, vessels from 72 in. to 60 ft, also flat surfaces. 8-page booklet gives physical characteristics, recommended thicknesses, efficiencies, photos. Kaylo Div, Owens-Illinois Glass Co, Toledo 1, Ohio

B29 **REFRACTORY DATA** — 8-page booklet gives unit dimensions, quantities of brick needed for turning circles, constructing walls. Standard fire brick, cupola blocks, wedge, key arch and circle brick listed. Ironton Fire Brick Co, Ironton, Ohio

B30 **SHOCK ABSORBERS** — Hydropneumatic accumulator absorbs shocks and vibrations of hydraulically operated tracked and rubber-tired equipment. 4-page bulletin 700 gives operating principles, installation diagram capacities. Greer Hydraulics, Inc, 454 18th St, Brooklyn 15, N. Y.

MAINTENANCE AND SAFETY EQUIPMENT

B31 **TUBE EXPANDERS**—For power and hand use, 1 to 6-in. OD tubes. 4-page folder 204-C has photos, dimensions, prices. Gustav Wiedeke Co, Dayton 1, Ohio

B32 **TUBE BENDER**—For ½ and ⅝-in. OD copper, aluminum, brass, etc thinwall tubing. Bends to any angle up to 180 deg. 2-page bulletin 3001 has photos, description. Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill.

B33 **PIPE THREADERS** — Also cutters, reamers, vises, thread-cutting oils, etc. 52-page catalog 49 has dimensions, photos, prices, descriptions of complete *Toledo* line. Toledo Pipe Threading Machine Co, 1425 Summit St, Toledo 4, Ohio

B34 **FIRE FIGHTING PRODUCTS**—Portable equipment. 12-page catalog CP-7-50M-51 describes foam nozzles, liquids, hand lines, play pipes. Illustrated. Rockwood Sprinkler Co, 38 Harlow St, Worcester 5, Mass.

B35 **LUBRICATING GREASES** — Aluminum Stearates. 16-page catalog traces history, manufacture, structure, properties, performance. American Cyanamid Co, Industrial Chemicals Div, 30 Rockefeller Plaza, New York 20, N. Y.

B36 **SAFETY TOOLS**—Spark-resisting construction. Wrenches, chisels, screw-drivers, hammers, pliers, etc. 4-page bulletin ST-5 has sizes, construction details. Ampco Metal, Inc, 1745 S 38 St, Milwaukee 46, Wis.

B37 **GRINDER-MILLER** — Runs at controllable speeds from 15,000 to 45,000 rpm; ¼ hp motor; for precision, high-speed applications. May be set up in tool mounts or used as a portable hand-tool. 2-page bulletin form F1 has photo, dimensions, construction features. Precise Products Co, Racine 1, Wis.

B38 **CIVIL DEFENSE EQUIPMENT**—28-page catalog G-12 offers outline of action for civil defense services, presents and describes equipment for first aid, emergency lighting, head and eye protection, cable splicing, etc. Mine Safety Appliance Co, Braddock, Thomas and Meade Sts, Pittsburgh 8, Pa.

MECHANICAL TRANSMISSION

B39 **FLEXIBLE SHAFTING**—64-page book describes advantages and applications; also shows end fittings, casings, adapters and shaft combinations. Over 400 illustrations. F W Stewart Mfg Corp, 4311 Ravenswood Ave, Chicago 13, Ill.

B40 **V-BELTS** — Single-groove type, with straight sidewalls and

No job is too unusual for NAVCO

Whether you require a simple pipe bend or a complicated prefabricated assembly Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

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NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

LOCKETT FUEL OIL PUMPING AND HEATING SETS

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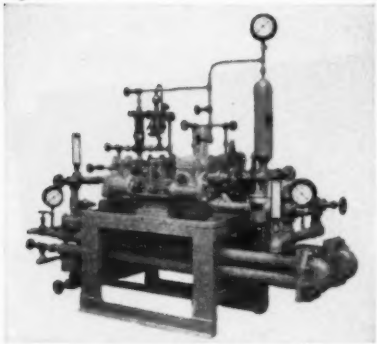

The efficient, compact unit illustrated consists of two Worthington Duplex Steam Pumps and two Griscom Russell Twin G-Fin Fuel Oil Heaters mounted on a single structural steel frame.

For almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

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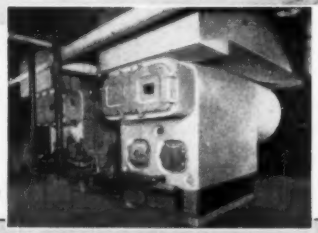


THE TITUSVILLE IRON WORKS COMPANY
a division of Struthers Wells TITUSVILLE, PENNSYLVANIA
Representatives in Principal Cities

More FREE BULLETINS

Begins on page 163

straight-in-line cords. Miniature bulletin 6830-B has photos, construction features, standard sizes and belt nos. Raybestos-Manhattan, Inc, Manhattan Rubber Div, Passaic, N. J.

B41 VARIABLE SPEED DRIVES—Miniature combination fixed and variable speed units for low power applications. 2-page technical data sheet M1 has dimensions, applications, ordering instructions. Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

B42 GEARS — 4-page bulletin illustrates line of gears and speed reducers, notes catalogs with complete information. Philadelphia Gear Works, Inc, Erie Ave and G St, Philadelphia 34, Pa.

METERS AND INSTRUMENTS

B43 INDUSTRIAL INSTRUMENTS — 28-page composite catalog No. 5000 describes the principal instruments, control devices, and related components manufactured by the industrial div. General specifications given, catalogs with complete information listed. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Aves, Philadelphia 44, Pa.

B44 PICKUPS—For linear and torsional vibration, and acceleration. 8-page bulletin CEC 1503 gives data on selection, application, uses. Specifications, photos, dimensions. Consolidated Engineering Corp, 300 N Sierra Madre Villa, Pasadena 8, Calif.

B45 SHAFT-MONITOR — Shaft-position indicators show angular position of a rotating shaft. Up to 20 readings per second, accuracy to ± .09 deg. 4-page bulletin gives description, operation, constructions. Photos, characteristics. Engineering Research Associates, Inc, 1902 W Minnehaha Ave, St Paul, Minn.

B46 OHMMETER — Low resistance, general purpose type. Two ranges —0 to 1000 and 0 to 10,000 microhms. 4-page bulletin 24-46 gives specifications, operating instructions, photos. James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

B47 FLUE GAS ANALYZER — Provides continuous recorded combustion analysis. Uses Davis thermal conductivity gas analyzer in combination with Brown *ElectroniK* recorder. Instrumentation Data Sheet 10.15-3a has 4 pages of photos, description. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne and Windrim Aves, Philadelphia 44, Pa.

B48 METER SOCKETS — 18-page booklet B-5284 gives information on how to select the proper meter socket, with initial information on only type of service desired and wire size. Socket descriptions, information on circuit-closing provision, terminals, style nos., etc. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

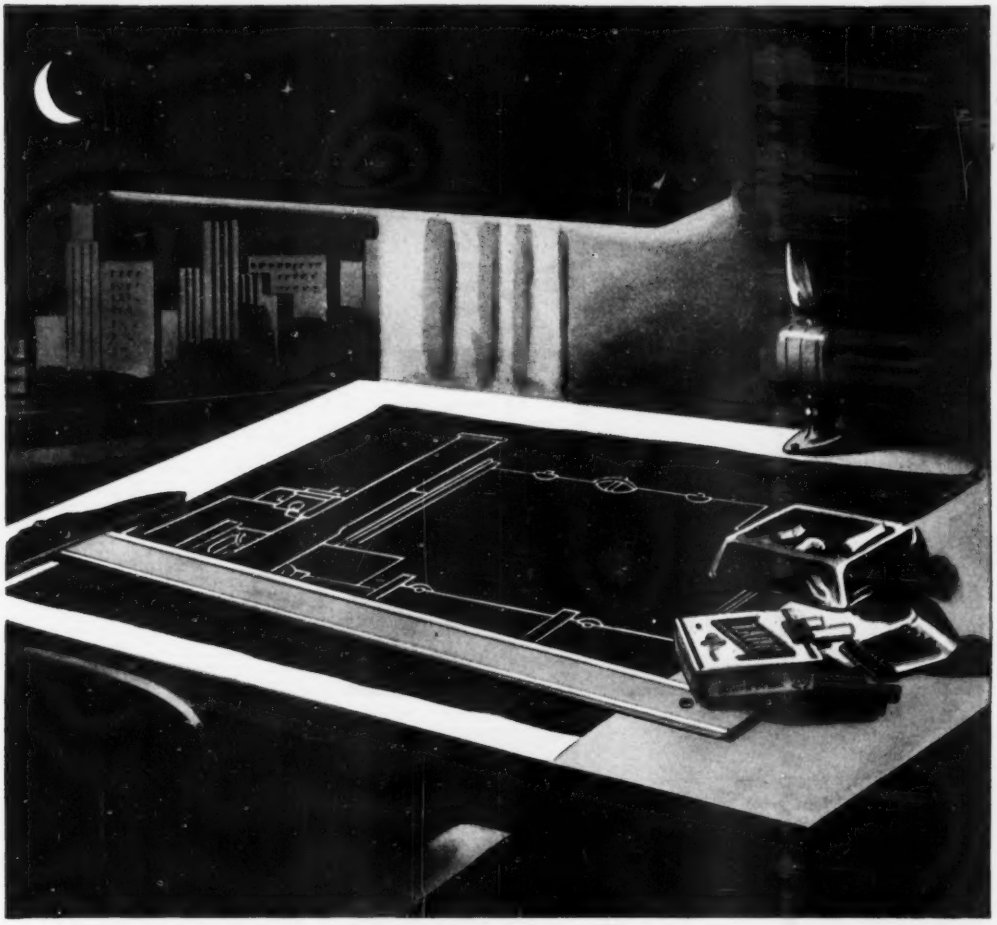
B50 SMOKE RECORDER — Developed primarily for use with electronic smoke, turbidity and color photounits. 2-page bulletin 512 gives description, specifications, wiring diagram. Ess Instrument Co, Bergenfield, N. J.

B51 FLOW METERS—For recording, integrating, indicating, automatic controlling, and telemetering flow of fluids. 40-page bulletin F1605 describes mechanical and electrical units. Photos, applications. Sales Promotion Dept, Bristol Co, Waterbury 20, Conn.

PUMPS

B52 ELEVATOR PUMPS—25 to 110 gpm at 300 psi. Direct or v-belt drive. 6-page bulletin No. 20 gives construction, dimensions, mounting layout, performance data. Geo D Roper Corp, Rockford, Ill.

B53 METERING PUMPS—For industrial and biological fluids. Corrosion resistant, non-pyrogenic. Fixed or



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Continuous progressive engineering is the reason why Preferred builds the finest unit steam generator. Day and night, detailed study and careful design work go into the planning of even the smallest part. As a result, Preferred has maintained a top-quality product that costs the least over its entire life span. Design and manufacturing standards have never been lowered to lower first cost. That's why Preferred still leads the field . . . why its many features assure you of at least 25 years of economical, low-maintenance service at a minimum efficiency of 80%. Bulletin 1000 contains complete data on the quality features of the Preferred Unit Steam Generator. Write for your copy.

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Precision-Built for faster, smoother

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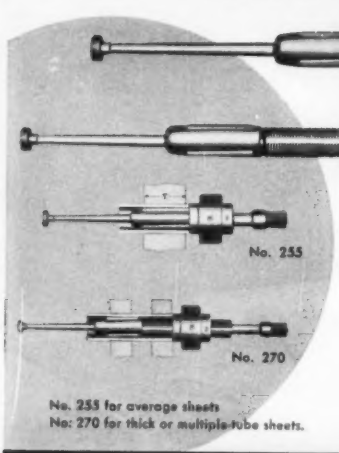

No. 255 for average sheets
No. 270 for thick or multiple-tube sheets.

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FRED S. RENAULD & CO. LOS ANGELES

More FREE BULLETINS

Begins on page 163

variable speed transmissions. 16-page catalog 51A has specifications, operating data. Mechanical Products Corp, 168 N. Ogden Ave, Chicago 7, Ill.

★ **VERTICAL PROPELLER PUMPS** —For flood control, drainage, irrigation and similar low head service. Bulletin W-314-B2 has drawings, dimensions. •Request direct on company letterhead. Worthington Pump and Machinery Corp, Harrison, N. J.

B54 CENTRIFUGAL PUMP INSTRUCTIONS—30-page booklet 08X7613 covers installation, operation and repair of single-stage, double-suction centrifugal pumps. Lists 40 causes of trouble and their cures, gives maintenance timetable, parts nos. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

B55 PROCESS PUMPS — Horizontal center-line mount type, for temperatures to 850 F, heads to 625 ft, capacities to 1000 gpm. 4-page bulletin B-1605 has specifications, construction features, parts list, dimensions, cutaway drawings. Peerless Pump Div, Food Machinery and Chemical Corp, 301 West Ave 26, Los Angeles 31, Calif.

B56 PNEUMATIC EJECTORS — For pumping sewage, drainage and solids-carrying liquids. 30 to 600 gpm. 12-page bulletin 4000-C shows operation, has photos, specifications. Yeomans Bros Co, 1433 N Dayton St, Chicago, Ill.

WELDING

B57 SHIELDED METAL-ARC PROCESS—For welding aluminum, aluminum bronze, silicon bronze, copper, nickels, stainless steels. Manual or automatic operation. 8-page catalog 17 shows *Aircomatic* hand gun, automatic head, and wleding wires. Air Reduction, 60 E 42nd St, New York 17, N. Y.

B58 WELDING AND CUTTING EQUIPMENT—Hand and machine torches, nozzles, tips, regulators, valves, etc. 64-page catalog 20-C gives information on complete line. Dimensions, photos, specifications. Victor Equipment Co, 844 Folsom St, San Francisco 7, Calif.

B59 STUD WELDING DESIGN—Stud selection, specifications, locating methods and template design, methods for accommodating fillet are discussed in 8-page manual Form D-1. Charts, tables, illustrations. Nelson Stud Welding Div, Gregory Industries, Inc, Lorain, Ohio

B60 WELDING ELECTRODES — Describes alloy electrodes most widely used in the defense program. Gives short history, general uses and typical properties of *Arcaloy, Armorarc,* and *Weld-Arc* electrodes. 16-page bulletin AR51-1. F R Walsh, III, Gen Sales Mgr, Alloy Rods Co, York, Pa.

B61 HARD-FACING ALLOY RODS—For electric or acetylene applications. Five 4-page bulletins Forms 320, 321, 322, 323, 324 cover the complete line, giving rod sizes, uses, applications. Victor Equipment Co, Alloy Rod & Metal Div, 11320 S Alameda, Los Angeles, Calif.

B62 LOW TEMPERATURE WELDING ALLOYS — Electrodes for cast iron, steels, copper, brass, aluminum, etc. 16-page directory has photos, sizes, chart of principal uses. Eutectic Welding Alloys Corp, 172nd St and Northern Blvd, Flushing 58, N. Y.

B63 TIN-PLATE TOUCH-UP — Pencil sacrifices itself to protect iron or steel. Tins hard-to-tin surfaces, regalvanizes damaged spots. Miniature 4-page folder. All-State Welding Alloys Co, 249 Ferris Ave, White Plains, N. Y.

B64 SILVER BRAZING — Low-temperature process. Complete library condensed to 48-page pocket-size manual has answers to questions on brazing, joint design, fluxing, etc; charts of specifications, thermal expansion of metals. American Platinum Works, 231 N. J. Railroad Ave, Newark, N. J.

LOOK!

NO STUFFING BOX...

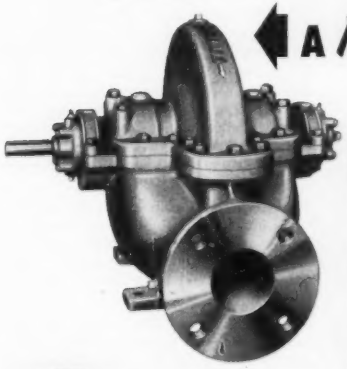
THE NEW PEERLESS TYPE **AS**

GENERAL PURPOSE PUMPS are designed around MECHANICAL SHAFT SEALS...

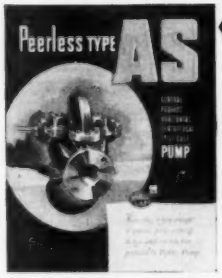
Here are **4** *Big Advantages:*

1) **NO LEAKAGE.** Simple, positive acting, shaft seals prevent leakage of liquid from pump.
2) **LESS MAINTENANCE.** Stuffing box is completely eliminated; maintenance trouble and expense is reduced to the minimum.
3) ***CUSTOM* PUMP–*STANDARD* PRICE.** The Peerless Type AS pump costs no more than ordinary split-case pumps. You get extra quality without paying a premium.
4) **EASILY SERVICED.** Entire rotating element can be removed from pump without disturbing line connections. Shaft seals and bearings are standard items, easily available from commercial sources.

PEERLESS PUMPS



A *NEW* PUMP
A *NEW* BULLETIN



Write for Bulletin No. B-1350 which completely describes and illustrates the modern design and construction features of Peerless Type AS pumps.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
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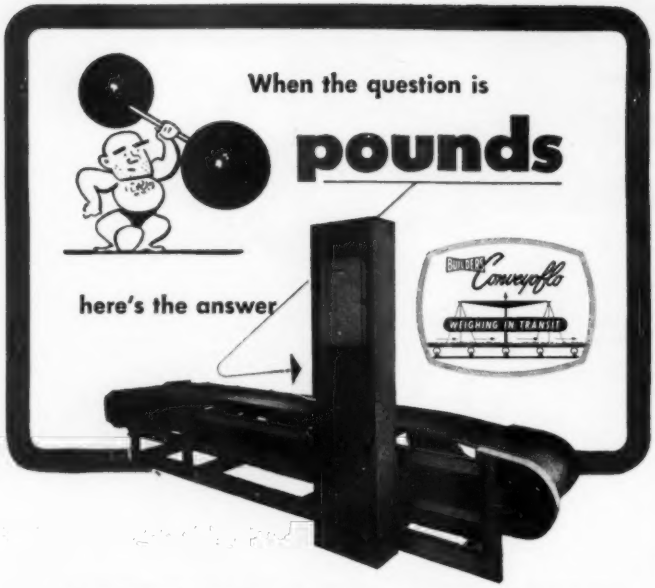
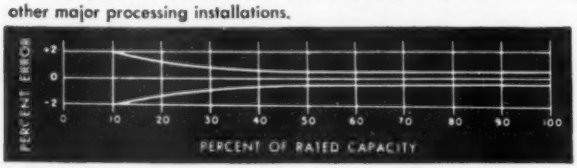
Food Machinery and Chemical Corporation
Address inquiries to Factories at:
Los Angeles 31, Calif. and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta; Dallas, Plainview and Lubbock, Texas; Fresno; Los Angeles; Phoenix; Albuquerque, N. M.; Tulsa.



For continuously weighing dry material such as coal carried on a conveyor belt, one meter is outstanding — Builders Conveyoflo. Conveyoflo weighs in transit. It keeps an accurate, continuous weight tally whether the material is tobacco (at 4 lbs. per cu. ft.) or nickel ore (at 175 lbs. per cu. ft.). Conveyoflo serves in food plants, power plants, refineries, tobacco plants, paper mills, fertilizer factories, sewage disposal plants, and many other major processing installations.



ACCURATE . . . within ± ½ of 1% of *actual weight* from maximum to 50% of rated capacity; within 1% from 50% to 25% rate; and within 2% from 25% to 10% of the rated capacity of the scale.

AUTOMATIC TOTALIZER COMPENSATION for variations in BELT SPEED and changes in BELT WEIGHT.

RESPONDS ACCURATELY to rapid load variations.

AUXILIARY FEEDERS, automatically paced for continuous blending processes, may be furnished.

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Yes, Conveyoflo Meter gives you the answers to your continuous weighing and blending problems in POUNDS, not GUESSES. For new Bulletin 550-H4, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 354 Harris Ave., Providence 1, Rhode Island.

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Instruments for recording, indicating, and controlling flow, liquid level, pressure, and weight. Chlorinizers — chlorine gas feeders.

APPOINTMENTS

Allis-Chalmers Mfg Co announces retirement of Hans P Dahlstrand, director of steam turbine engineering, after 47 years of service with the firm. He was in charge of designing many famous steam turbines between 1915 and 1942. Among these were the first 825 F turbine and the first of the renowned reheat turbines that contributed to the Port Washington station (Wisconsin Electric Power Co) world record for thermal efficiency.

In 1942 he became consulting engineer of the steam turbine dept, and in 1948 director of steam turbine engineering. He was a member of the internationally recognized ASME test code committee from 1918 to 1946, and has presented many significant technical papers on steam turbines. In 1925 he presented his famous paper proposing the advantages of topping turbines, aiding the power industry to increase capacity of older stations 25 to 40% without materially increasing requirements for cooling water for condensers.

Photo above shows Dahlstrand (right) receiving well-wishes from W A Yost Jr, gen machinery div vice-president.

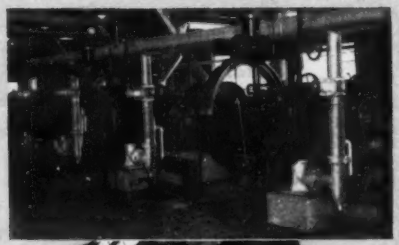
Westinghouse Electric Corp names George W Jernstedt mgr of engineering for the special products development div, and appoints George E Goodrich asst mgr, industrial dept, of the apparatus div. C F Sponsler is mgr of the land transportation section of the transportation dept; Robert W Gray is asst mgr of industrial relations at E Pittsburgh.

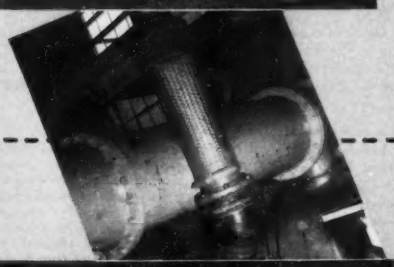
Worthington Pump and Machinery Corp announces retirement of Herman H Miller, authority on compressors, after 50 years' service. B A Bauer becomes purchasing agent and supervisor of stores at Oil City, Pa.

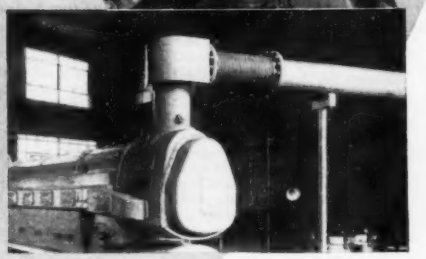
Norton Co appoints Dr Newman W Thibault chief of new physical research section and Richard E Englund grinding service engineer in the research and development dept. This dept was previously under H Walter Wagner, co-inventor of high-strength grinding wheels and two-fluid grinding, who retired Dec 31.

Robert W Cornish becomes supervisor of training in the personnel dept. J Richard Leonard is new grinding machine sales representative in Worcester, Mass.; George

Large Diameter CMH REX-WELD CORRUGATED FLEXIBLE METAL HOSE







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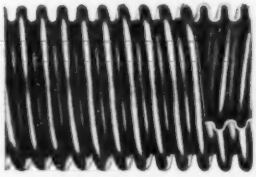
Wherever large diameter connections must have the flexibility to absorb vibration or expansion and contraction, correct for misalignment or allow movement, and yet provide the rugged durability of metal, CMH REX-WELD Type RW-75 is the answer. REX-WELD Type RW-75 is the flexible connection that requires no packing, no periodical maintenance. All metal construction is completely gas and liquid tight.

For full information and data sheets see your local CMH distributor—look for his name in your classified telephone directory—or write direct.



CMH REX-WELD Type RW-75 is helically corrugated flexible steel hose and is made in sizes from 5" to 24" I.D., inclusive. Furnished with standard pipe nipples, couplings, fixed or floating flanges. Flanges to customers design can also be attached. Where required RW-75 can be supplied with metal braid covering.

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Manufacturers of Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

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BELMONT SHEET PACKINGS

ANSWER YOUR NEEDS...

Ever have a packing failure? Then you don't have to be told the high cost of unscheduled maintenance and interrupted service. Knowing the importance of tight, uniformly dependable seals, why not investigate the packings whose performance has identified them with better sealing—LONGER .... Belmont's scientifically formulated and controlled sheet packings.

Standard items are offered in sheets or rolls ... compressed asbestos, asbestos metallic, rubber sheets in all durometer hardnesses including natural rubber and oil resistant synthetics, cloth inserted, vegetable fibre and a variety of other materials and combinations. Belmont Sheet Packings and Gasket Cutters are sold nationally through distributors. Call yours for service or, where technical assistance is required, write direct.

Catalog #40 Available

CUT YOUR
OWN GASKETS
WITH BELMONT GASKET CUTTER
4-M-3A
A portable tool for cutting 1½" dia. to 19" dia. circular gaskets from all kinds of soft sheet packings. Rigid and simple to operate. Larger sizes only require cutter bar replacement.

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Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service

More APPOINTMENTS

Begins on page 226

A Fyrberg is production mgr of the abrasive div; Everett M Hicks is elected vice-president and a director of the company.

Babcock & Wilcox Co names Adin B Capron chief engineer of the tubular products div; Clayton Carl becomes supt of the West Point, Miss. works.

Hewitt-Robins Inc appoints Norman M Godfrey mgr of the eastern sales div, and forms a new south central sales div with headquarters at Houston, Tex., in charge of L C Holloman, asst div mgr. G V Migula becomes mgr of the western sales div with headquarters in San Francisco.

Monsanto Chemical Co appoints Wm J Katt mgr and George B Boon asst mgr of the design section of their general engineering dept. Milton Welhoelter becomes project chief engineer of the atomic electric project sponsored jointly by Monsanto and the Union Electric Co of Mo.

Allis-Chalmers Mfg Co appoints J C Pohlman application engineer in the transformer section; Wm M Wallace is new assistant to the vice-president of the gen machinery div.

De Laval Steam Turbine Co forms a subsidiary corporation, the De Laval Turbine Pacific Co, with headquarters at Main and Folsom Sts, San Francisco. Company officers are G W Smith Jr, chairman; J P Stewart, president; C F Reeves, vice-president and gen mgr. Branch sales offices are in Los Angeles, under H H Reynolds, dist mgr, and Seattle, under J A Greenland, dist mgr.

Vancouver Engineering Works, Ltd becomes exclusive De Laval representative in British Columbia, Canada. J H Metzgar is appointed sales mgr of the standard products div at Trenton, and C E Cromwell is sales mgr of the commercial div.

Raybestos-Manhattan, Inc, appoints R B Hazard sales mgr of the packing div at Manheim, Pa. Completion of the initial unit of new Wabash div at Crawfordsville, Ind., is announced.

Air Reduction Magnolia Co appoints John Lund dist mgr at Shreveport, La.

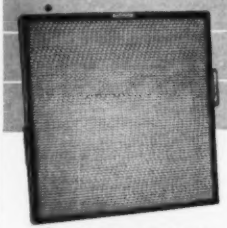
Dravo Corp appoints Elmer W Easter naval architect of its engineering works div, and Wallace P Warner staff advisor on personnel procurement.

General Electric Co announces retirement of Wm E Ruder, leading authority in the field of permanent magnets and magnetic materials, after 44 years of service. He was mgr of the research lab's metallurgy research dept.

Ruder developed the powerful alnico permanent magnets, and the so-called *soft* magnetic steels, which improved the efficiency of electrical transformers and also developed the *calorizing* process for coating iron and other metals with aluminum.

Earl W Cunningham becomes gen mgr of the industrial heating dept at Schenectady. The chemical div appoints John L McMurphy gen mgr of the plastics dept; Sam L Brous gen mgr of the chemical materials dept; James W Raynolds marketing mgr

Now you can have
Performance Rated
Air Filters



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- *testing methods that*
- *take the guesswork out*
- *of air filtration!*

All architects, engineers and reputable filter manufacturers know this important fact about air filters: *no filter—regardless of its design—operates at equal efficiency under all dust conditions.* For example, a filter may stop "gravel" with 100% efficiency, but may have 1% efficiency when exposed to dust particles of 0 to 5 micron size. (1 micron—1/25,000 inch.) The new FAR-AIR testing methods accurately rate filter efficiencies under *all* dust conditions—not just one set of laboratory conditions using a "standard" test dust, as in the past.

THIS IS IMPORTANT TO YOU because, for the first time, you can buy air filters whose performance rating under your operating conditions is accurately determined in advance. No more guesswork when you buy FAR-AIR filters! You may also save needless expense by installing the type filters that are no more efficient than necessary to meet the requirements of the job.

This tremendous advancement in the science of air filtration is ready to serve you now. Your nearby Farr Field Engineer can be of valuable assistance in solving your air filtration problems. Why not call him today?

Write today for your copy of the free booklet on the new Farr testing procedures, which gives full technical information on the equipment used in these tests and the results obtained. Address: Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, Calif.

FAR-AIR FILTERS
"Better by Farr"

FARR COMPANY
Manufacturing Engineers
Los Angeles • Chicago • New York
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how many BTU'S in 80 of these?

THERE are other ways to burn up thousand-dollar bills, and maybe you are doing just that in your boiler room.

This is what we mean. Assume that a boiler may be expected to give 200,000 hours of service. A 100,000 lb/hr boiler will burn at least $8,000,000 worth of fuel in that time.

Now—if your combustion control system permits as little as one per cent of that fuel to be wasted, your control system could cost you $80,000 more than you paid for it—five, six, or seven times as much as the initial cost of the system itself!

From this point of view, you cannot afford to buy anything less than the best.

The long experience of Hagan Corporation's engineers with all types of combustion control applications is a prime factor in their position of acknowledged leadership.

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BOILER COMBUSTION CONTROL SYSTEMS
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METALLURGICAL FURNACE CONTROL SYSTEMS
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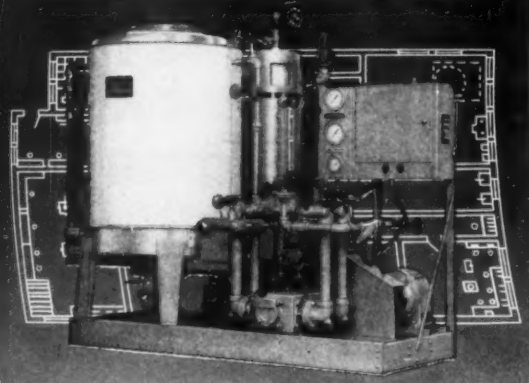
MORE STEAM
Faster and at Less Cost



SPECIFY *Clayton*
FORCED RECIRCULATION
STEAM GENERATORS

Plan your steam plant for long range economy and realize immediate savings on installation and operating costs.

The Clayton *Forced Recirculation* Steam Generator...in sizes from 15 to 100 h.p., and equipped to burn gas or oil, or both...is a compact, self-contained steam plant ready to install and operate as it is delivered. No accessories to buy. No stack, bricking or foundations to install. Move into place; connect fuel and water lines, electricity and vent, and the Clayton generator is ready to operate. Occupies 30% to 70% less space than conventional boilers of same capacity.

Within 5 minutes from a cold start, the Clayton generator attains full operating pressure. Any fluctuating load demand within its rated capacity is instantly and automatically met. No standby losses. High thermal efficiency cuts fuel costs in half, or better. On gas fired units, new electronic safety control proves the flame pilot; automatically shuts down plant on ignition failure or loss of fire. Clayton generators are built to conform to the A.S.M.E. Boiler Code, and are Hartford inspected. Send the coupon for complete catalog.

The coupon below brings a convincing demonstration to your desk.

STEAM PLANT OPERATORS *Mail this coupon*

CLAYTON MANUFACTURING COMPANY P-3
Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton *Forced Recirculation* principle. Send catalog.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

Animated flow chart shows how *Forced Recirculation* principle cuts steam costs.

More APPOINTMENTS

Begins on page 226

of the div; and Dr Alphonse Pechukas div engineering mgr. Edwin M Irish Jr is phenolic products sales mgr. C S Jones and J R Conley become north central dist representatives, construction materials div.

Davey Compressor Co appoints L W Darling mgr of government sales and Frederick C Kieser export mgr.

Owens-Illinois Glass Co Kaylo div reorganizes its insulation sales force. New regional sales supervisors are Thomas F Sears, southwest, office in Houston, Tex.; Lewis F Scott, midwest, office in Chicago; Robert L Long, east, office in Toledo. New branch mgrs are Arthur B Pike, Boston; Carl Ramien, Philadelphia; Robert L Major, Pittsburgh; Ike Keith, St Louis; James Hailey, Cleveland.

Homestead Valve Mfg Co appoints Don H Krey vice-president in charge of sales, and John W Force vice-president in charge of engineering.

Hall Laboratories, Inc transfers Alex M Henricks to the service engineer headquarters staff; moves Edward S Stewart to the Boston office; transfers Douglas E Noll to the headquarters staff.

General Cable Corp appoints W J Richard asst chief engineer at Perth Amboy; W S McClintic becomes eastern dist engineer at New York. S A Smith Jr is treasurer of the corporation, and Ralph W Atkinson director of research.

Fluor Corp, Ltd elects J S Fluor president, and D W Darnell chairman of the board.

Peerless Pump Div, Food Machinery and Chemical Corp, appoints Roy F Brisbois process pump specialist in Los Angeles.

Askania Regulator Co opens branch office at 1244 Commercial Trust Bldg, Philadelphia. Robert J Kroth is dist mgr.

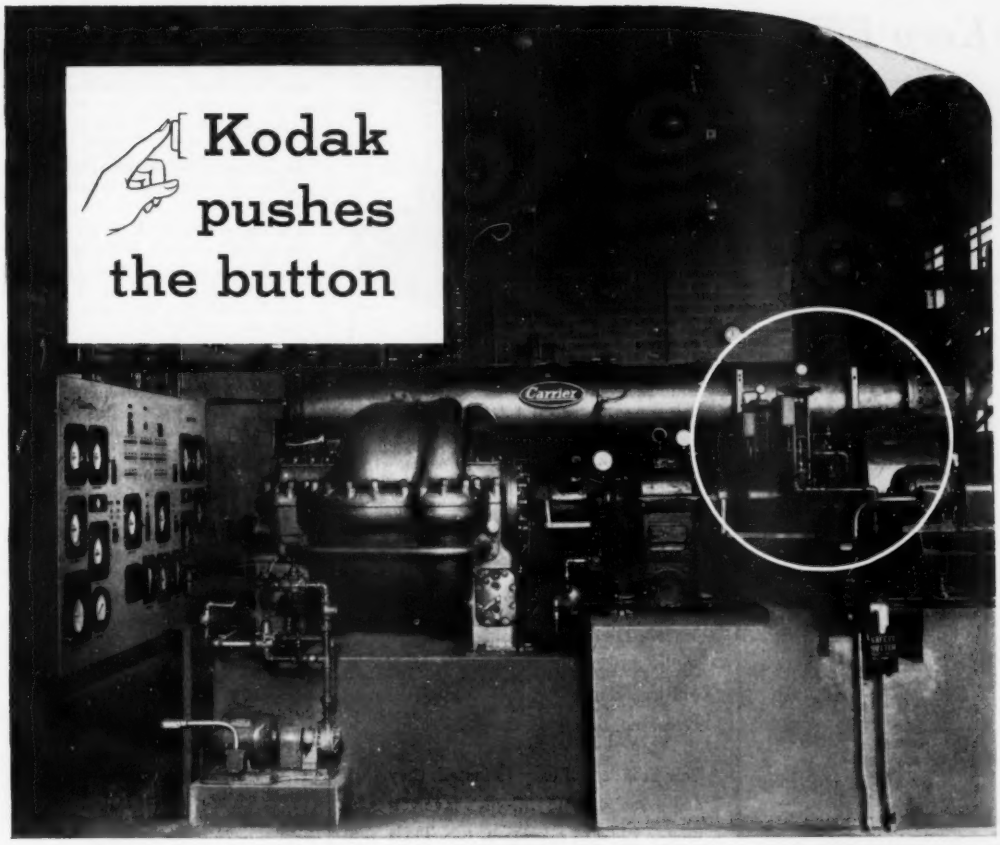
Ampco Metal, Inc appoints Ben R Hecker field engineer in Detroit. Upton, Bradeen and James Ltd of Canada becomes exclusive distributor, with main offices in Toronto, Ont.

Union Carbide and Carbon Corp elects Dr George O Curme Jr director in charge of research.

Thermoid Co appoints A F Matheis asst sales mgr of industrial rubber products, and Carrol Hall becomes asst factory superintendent of the Essex Rubber Co, a subsidiary.

Timken Roller Bearing Co promotes George J Muntean to asst superintendent of the Canton bearing factory.

U S Rubber Co appoints Louis J Coppola mgr of government sales for the mechanical goods div, succeeding George H Pendleton who is retiring. The research and development dept of the Naugatuck chemical div appoints Dr C D McCleary mgr of basic research; Dr J N Judy becomes mgr of process development; C G Durbin is mgr of technical services laboratories and personnel relations; Ivan Man-



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in controlling the refrigeration system at Kodak's huge new Distribution Center at Rochester, N.Y.

This center handles practically every Rochester-manufactured Kodak product for storage, packing and shipping in its 476,000 square feet of floor space.

Air conditioning for storage of sensitive photographic films and papers is extremely important, and it starts off right with these 250-ton Carrier centrifugal compressors which supply the chilled brine to the Taylor controlled temperature zones . . . "the most fully automatic compressors we ever installed", say Carrier engineers about these Taylor controlled centrifugals.

Taylor controls keep the output temperature of the chilled brine constant by regulating the oil volume in the hydraulic coupler (circled) between the compressor itself and a constant speed motor. During periods of minimum load, an ingenious hot gas by-pass induces a load on the compressors to eliminate surging and keep the system fully automatic. From Friday night to Monday morning, when the load is especially light, the system automatically keeps the brine temperature constant with *no manual attention whatever.*

No matter what your air conditioning or refrigeration problem may be, you'll get most efficient operation from your equipment when it's under Taylor Control. Ask your Taylor Field Engineer, or write for **Catalog 300.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

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IN HOME AND INDUSTRY

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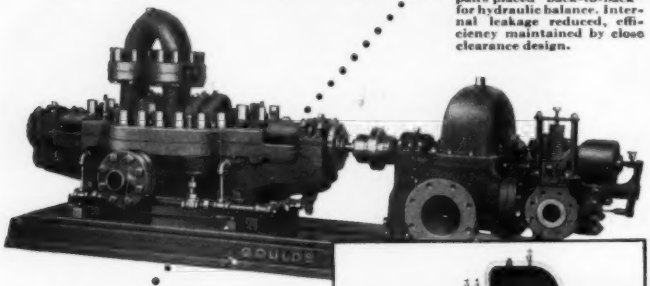
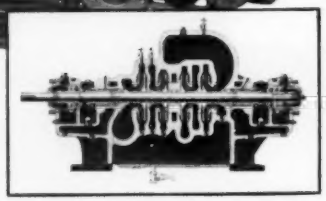


GOULDS Fig. 3360
Single-suction impellers in pairs placed "back-to-back" for hydraulic balance. Internal leakage reduced, efficiency maintained by close clearance design.



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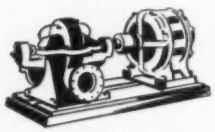
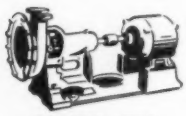
High Pressure Centrifugal Pumps

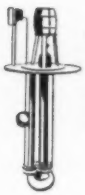
Other GOULDS Pumps for Heavy-Duty Service



GOULDS Fig. 3450
These double-suction, single-stage Goulds centrifugals will handle up to 15,000 G.P.M. Heads up to 500 ft. Bulletin 721.2.



GOULDS Fig. 3705
Stainless steel pumps for handling acid and alkaline liquors. Capacities up to 600 G.P.M. Heads up to 160 ft.



GOULDS Fig. 3047
Nonclogging impeller of this vertical sump pump will handle water containing large solids or fibrous materials.

In power plant boiler feed service or other installations where high pressures and temperatures are encountered, it will pay you to specify Goulds High Pressure Centrifugal Pumps.

Low in cost and easy to install, they assure real economy. Goulds save you money while in operation, too. Their simple, durable construction provides years of 24-hour-a-day trouble-free service . . . means lower replacement costs and reduced maintenance for you.

The Goulds Fig. 3360, pictured above, is available in bronze fitted construction with heavy-duty, double ball bearings, in sizes 3" to 8", stages 2 to 8, capacities to 2250 G.P.M. Heads to 3050 ft. Bulletin 722.5 contains details and specifications. Write for it today.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

More APPOINTMENTS

Begins on page 226

kowich becomes mgr of reclaim development. The div opens a new southwestern branch office at 1480 N Thomas St, Memphis, Tenn., in charge of Arthur Thomas Jr.

Sola Electric Co announces appointment of Hans U Hjermstad as vice-president in charge of engineering.

A P Green Fire Brick Co appoints A R Barnett vice-president in charge of sales.

Youngstown Sheet and Tube Co appoints James A Hale dist sales mgr in charge of the Cleveland office, succeeding F A Olmstead who died Dec 28.

Wagner Electric Corp promotes H S Garrett and J V Christman to assistants to the director of purchases, with M W Cox as supervising buyer.

Bailey Meter Co appoints W Powell Jr mgr of the Buffalo branch office.

Western Precipitation Corp opens district office at 1429 Peachtree St, N W, Atlanta, Ga., under Kenneth H Cree.

Parker Appliance Co appoints Wallace Tube Co 838 S 6th St, Milwaukee 4, as authorized warehouse distributor for tube fittings. L F Rosenmayer is in charge.

Permutit Co appoints R B Bruns dist engineer at Philadelphia, and M Blundon dist engineer at Decatur, Ill. Clyde R Poore becomes asst sales engineer at Charlotte, N. C.

National Aluminate Corp appoints Frank N Kemmer eastern representative of the ion exchange dept.

Flexible Metal Hose Mfg Co is new source for flexible metal conduit and hose. Plant is at 640 W 17th St, Costa Mesa, Calif.; Elton Hallett is president.

Diamond Power Specialty Corp elects Wm J Fitzburgh president and Willis P Thomas chairman of the board.

Borg-Warner Corp promotes W W Kovalick to production mgr, and H T Burke to acting chief engineer. Fred H Kroeger is sales mgr in charge of power brakes and devices.

American Locomotive Co appoints Wm H Clark general purchasing agent, following the retirement of Wm K Farrell. James H Link is named executive assistant to the president.

OBITUARIES

Walter P Berg, vice-president and director of Dravo Corp, died suddenly on Feb 3, at Pittsburgh. He was 60.

Herbert A Strom, 68, noted pump designer and chief designing engineer of Weinman Pump Mfg Co, died Jan 20.

Helmuth C Gardett, 73, retired chief electric engineer of the Los Angeles Dept of Water and Power died Dec 25 in Los Angeles. He supervised most of the municipal power system's major construction, including the first power plant in San Francisquito Canyon. Hoover transmission line and the harbor steam plant.

Here's the Only 300 Lb. Steel Valve Which Gives You

All These Features

Compare it — feature by feature — with any other cast steel valve you can buy. Not only is it outstanding for metal quality, in the famous Lunkenheimer tradition, but it includes *all* these advanced design features:

1. Backseating surfaces that let you repack while the valve is wide open and under pressure.
2. A smooth, straight-through waterway and full-rising disc to permit even flow and cut turbulence.
3. Swing-down eyebolts that can't become detached — and a convenient shelf that holds the gland flange up, out of the way, during maintenance.
4. Flexible tee-head stem connection that permits the disc to adjust to its seat without binding.
5. Trim combinations for specific applications to assure the **right** valve for the job.
6. Modern end-seated seat rings that seal perfectly against the body to guard against corrosion and leakage.

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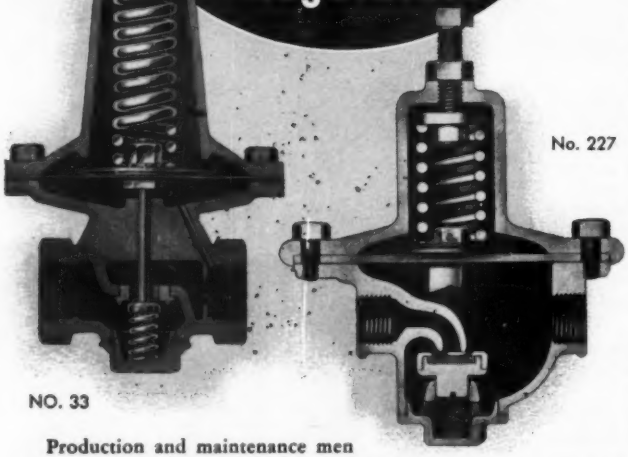
Regulators



No. 227

NO. 33

Production and maintenance men can count on Masoneilan Pressure Reducing Valves to give accurate control of steam, water or air. Quality constructed of high grade materials they give long-lived service . . . require minimum of maintenance because they are *built up to the job* not down to price.

No. 33 for steam or air service—sizes from ⅛" to ¾". Reduced pressure ranges 2-20; 20-40; 40-100 psi. Maximum working pressure 200 lbs.

No. 227 for water service — sizes ¼" to 2". Reduced pressure ranges 10 to 60 psi. Maximum working pressure 150 psi. Also available for air service from ¼" to 1".

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ENERGY CONCEPTS

Continued from page 78

$$N_3\left(\frac{N_3}{1+2N_3^2}\right)^{\frac{\gamma+1}{\gamma-1}} = \frac{a_2}{a_3}N_2\left(\frac{N_2}{1+2N_2^2}\right)^{\frac{\gamma+1}{\gamma-1}} \quad \text{(gas-area function)} \tag{65}$$

and for liquids

$$N_3^2/1+2N_3^2 = (a_2/a_3)(N_2^2/1+2N_2^2) \quad \text{(liquid-area function)} \tag{66}$$

These area functions and the pressure function of (63) and (64) are shown on Fig. 8. By using these curves with their corresponding equations space changes of flow can be readily calculated. If N_2 is known, the appropriate function of N_2 from Fig. 8 can be multiplied by the appropriate area or pressure fraction to obtain the corresponding function of N_3. Thus N_3 can be picked off of Fig. 8. This procedure can be reversed.

Since the area function for liquids has no peak value, any space flow approaching a region P_3 less than P_2 will continue to increase in velocity ratio if the original N_2 is greater than 0.707. If it approaches at less than $N_2=0.707$ it will decelerate into the lower pressure region. When accelerating, its area decreases and it receives energy from space. When decelerating, its flow area increases and it yields up energy to surrounding space.

This is the basic phenomenon of inlet cavitation of pumps. If the flow approaches the minimum pressure region of a blade curve at $N_2>0.707$, it will suddenly accelerate to a very low pressure. Typical tests[3] of $N_2=1.0$ flow attempting to pass around a $-12°$ turn show the absolute P_3 to go as low as 2 in. Hg.

With ordinary water supplies at normal temperatures when a pressure of much under 2/5 of an atmosphere is reached, air suddenly flashes out of solution. Once this process starts, violent surging occurs.[4]

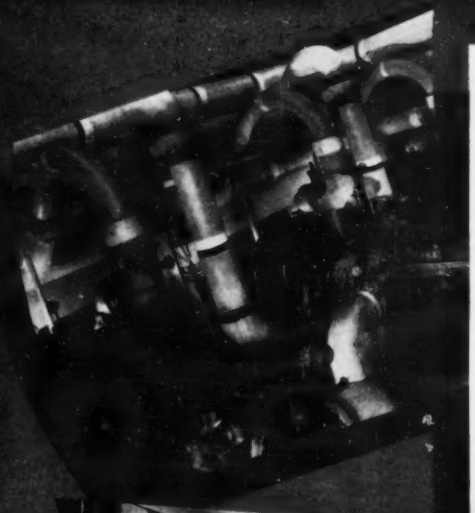
When velocities are high in pump and turbine inlets, supercharging the inlet to a higher P_2 has the effect of decreasing $N_2^2 = v_2^2/2gP_2V_2$ to a safe value.

Fig. 8 shows that the area function for gases, (65), increases up to $N=(\gamma/2)^{1/2}$ or 0.8367, and then decreases as N increases further. This means that, when gas flow approaches the rapidly changing section of an airfoil or compressor blade at a local $N_2>0.707$, space flow will accelerate with decreasing pressure and area until $N_3=(\gamma/2)^{1/2}$ is reached. When this point is reached further acceleration calls for an area reversal in space which terminates in discontinuity and unstable behavior.[5,6]

This same effect also shows up in nozzles when the supply pressure P_o is raised above the critical ratio shown on Fig. 6. For the nozzle represented by Fig. 5, whenever N_3 exceeds $(\gamma/2)^{1/2}$, P_2 rises above P_3. Repeated tests[3] of such nozzles reveal visible shock diamonds soon after P_3 exceeds P_2.

When air at various values of N_2 above 0.707 is asked to pass around −6, −10 and −12 deg turns the same checks are observed[3]. In the range from an approach N_2 of 0.60 to 0.70 the flow is noisy, erratic and often unstable, but once the transition occurs little noise is present. Velocity and impact temperature traverses verify energy transfer inward from the outer stream tubes. Velocity near the surface increases greatly and decreases further out, and the same is true of impact temperatures.

3—Unpublished tests of RPI ME Dept 1951-52.
4—*Measurement of Turbine Vibration*, by J. Parmakian and R. S. Jacobson, Paper No. 51-A-88, Nov 1951 annual ASME meeting.
5—P 368, *The Brown Boveri Review*, Oct 1950.
6—P 41, NACA *Technical Note 2251*, Dec 1950.



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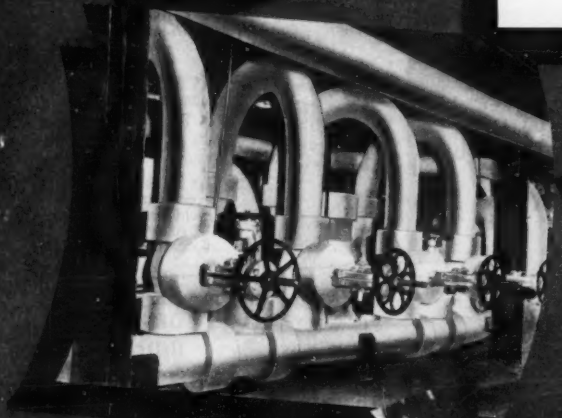

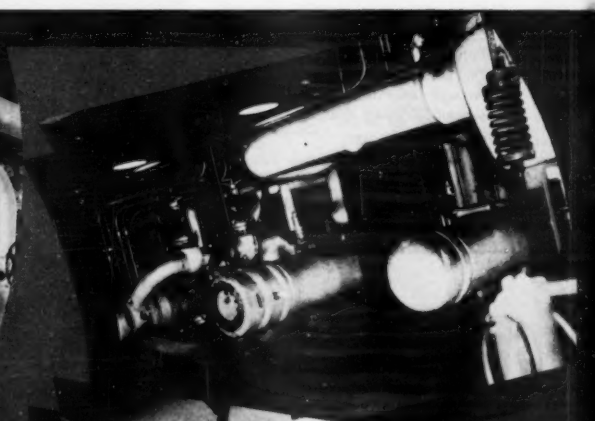

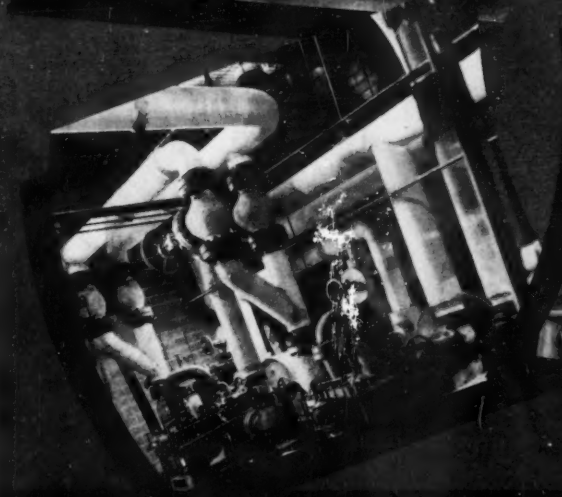

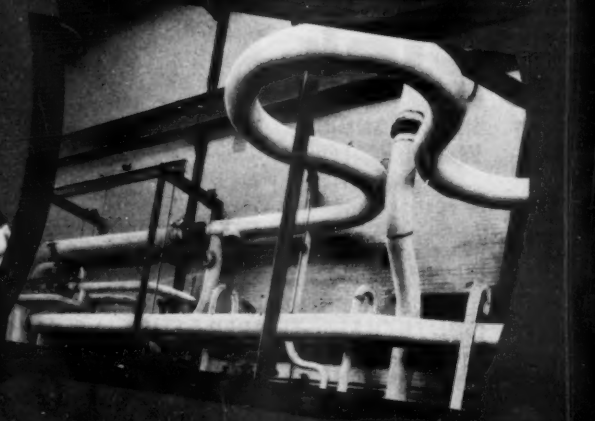

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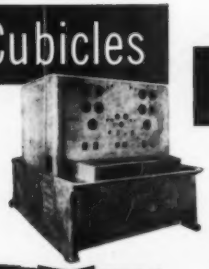

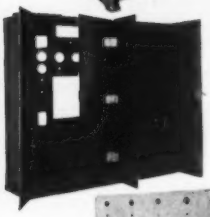

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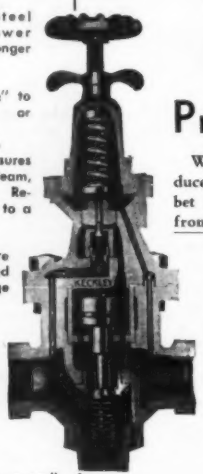

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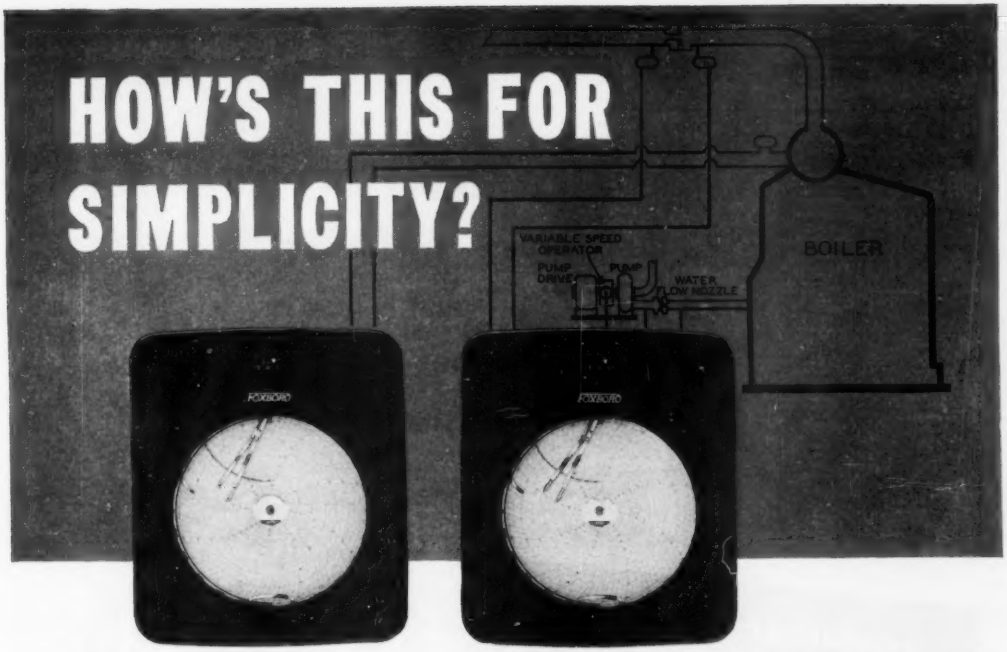

M-40 Recording Liquid Level Controller

M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller

3-Element Control for Boiler Feed Water with ONLY 2 INSTRUMENTS... NO AVERAGING RELAYS

Here's an opportunity to simplify boiler feed water control . . . and make it more dependable too. With this Foxboro system on a boiler of high steaming rate and low drum capacity, you get all the advantages of 3-element control, *plus* ratio-setting automatically adjusted by boiler water level. Ratio setting is undisturbed by the temporary effect of "swell" or "shrink" caused by sudden load changes.

This new standard of simplicity and dependability in boiler feed water control is made possible by two Foxboro Instruments, the M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller and the M-40 Recording Level Controller. The flexibility of Pneumaticset is outstanding . . . making the following combinations available almost instantly: (a) full automatic—steam flow/-water flow ratio controlled, with ratio set by level; (b) semi-automatic—steam flow/water flow ratio controlled, with ratio set by hand; (c) remote manual—feed water valve manually positioned from instrument.

Engineering data are available to help you check and compare this system. Write **The Foxboro Company, 683 Neponset Avenue, Foxboro, Mass., U. S. A.**

THESE M-40 FEATURES INSURE UNUSUAL RELIABILITY

1. Unmatched ease and stability of adjustment 2. Emergency-proofed—instrument can be dismounted without disturbing manual control panel 3. Self-aligning ball linkage—pinch clip for easy removal 4. Main and sub-assemblies interchangeable with those of other M-40 Controllers 5. Precision-built, inside and out 6. Proportional band setting, 0 to 200, either direct or reverse action made by turn of dial 7. Wide range variable reset resistance, 0.1 to 50 minutes, without use of needle valves or lengths of capillary tubing

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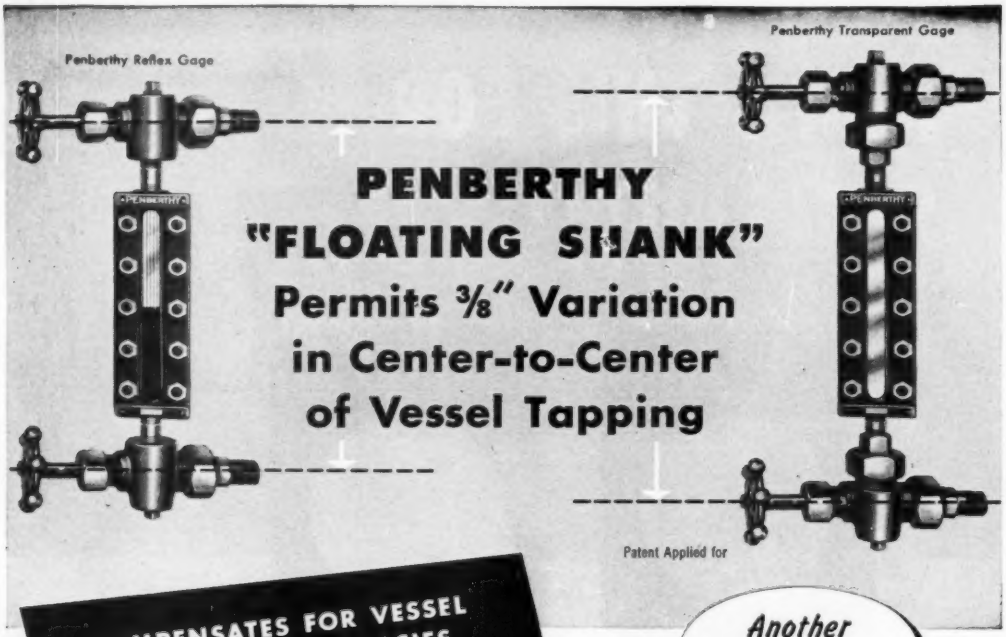

COMPENSATES FOR VESSEL TAPPING INACCURACIES

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SAVES INSTALLATION TIME

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REDUCES GAGE STRESSES

Another **PENBERTHY** *First*

An important new feature now available on all Penberthy drop forged steel gage valves is the "floating shank" . . . an improvement that has money-saving advantages to many users of liquid level and water gages.

The "floating shank" compensates for inaccuracies in the center-to-center distance of the tapped holes in the vessel on which the gage is mounted. The variation can be as much as 3/8". It provides a mounting flexibility not elsewhere obtainable . . . it saves time during installation of the gage . . . it eliminates stresses that are often induced during mounting.

The Penberthy "Floating Shank" can be had at slight additional cost . . . specify it on your next order for Penberthy drop forged steel (or alloy) gage valves.

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DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

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Established 1886 *Canadian Plant, Windsor, Ontario*

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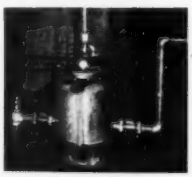
Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



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Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

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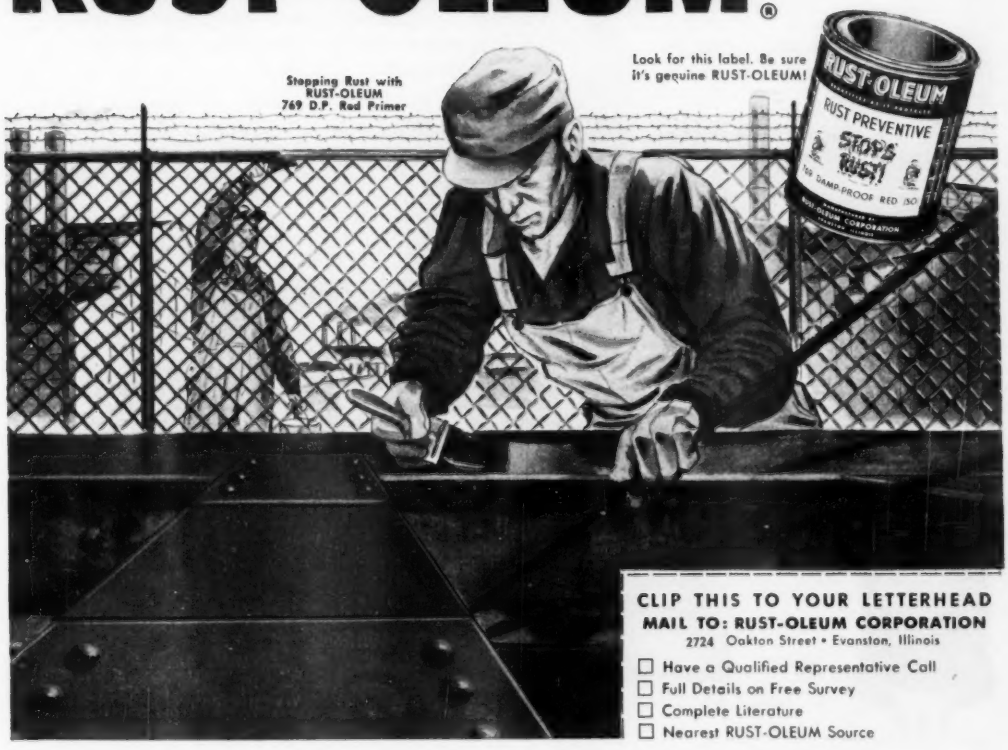

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Utilize the flexibility of

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Check this Flexibility

√ *Variety of circuits . . . potentiometer; Wheatstone, Kelvin and impedance bridge . . . for use with wide selection of sensing elements, including thermal converter illustrated on opposite page.*

√ *Variety of built-in switches for audible or visual alarms and signals.*

√ *Variety of chart speeds, from ½" to 120" per hour.*

√ *Variety of single-point and multi-point models, in choice of printing speeds.*

THE flexibility of the entire line of Brown instruments makes available a variety of combinations well qualified to fill the measuring, recording and signalling requirements of any power plant. Use of standard, interchangeable components simplifies maintenance, reduces parts-stocking problems.

Thanks to this flexibility, the *ElectroniK* Recorder is applicable to measuring temperature, pressure, flow, speed, pH, conductivity, power, current . . . the *same basic instrument for all*, with changes only in measuring circuit and sensing element.

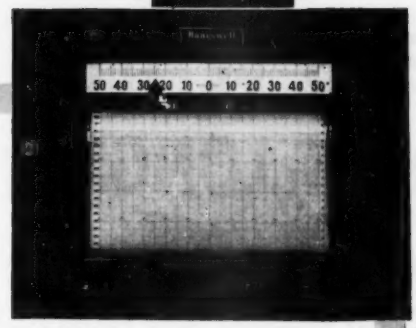
Check the flexibility features . . . then call in our local engineering representative for a discussion of how they can add to your operating efficiency.

Dependability, Too!

The dependability you demand from your recording instruments is insured by the *ElectroniK* Recorder itself *and* by *Honeywell's nation wide* service organization . . . by the dependability of primary components which are life-tested, service-proved and designed for minimum, easy maintenance. You can appreciate at a glance the ruggedness of the high-torque balancing motor, the hermetically sealed converter, the simplified *continuous-balance* amplifier . . . as well as the minimum of moving parts and the obvious freedom from adverse effects of dust and atmospheric humidity.

ElectroniK Potentiometers

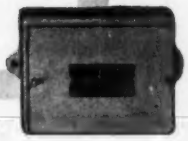
of megawatts and megavars



THE *ElectroniK* POWER RECORDER

Important Features:

- *Continuous Balance measuring system with electronic non-cyclic balancing, proved in thousands of industrial installations.*
- *Selection of ranges for generator output, station total generation, and tie line interchange.*
- *11-inch wide scale, readable at a distance . . . open, legible chart for detailed recording.*



WHEREVER continuous measurement and recording of electrical power are needed, the *ElectroniK* Recorder meets every power engineer's specifications. Supplied for any desired megawatt range, the instrument works with a thermal converter connected to standard instrument transformers. By adding a phasing transformer to the detecting circuit, it is readily adapted to measurement of reactive or "wattless" power.

Operating men like the *ElectroniK* Recorder's speed and accuracy, its 11-inch wide scale and chart which spreads load curves out in easily readable detail.

Maintenance men like the *ElectroniK* Recorder's ruggedness and simplicity, its small number of moving parts, its complete freedom from delicate mechanical linkages, its easily-serviced unit construction.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Phila. 44, Pa. Service facilities available in more than 55 cities in the United States.

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BROWN INSTRUMENTS

First in Controls

● *Important Reference Data*

WRITE FOR DATA SHEET NO. 9.1-3...CATALOG 90-2, "SUPERVISORY INSTRUMENTS FOR POWER GENERATION."

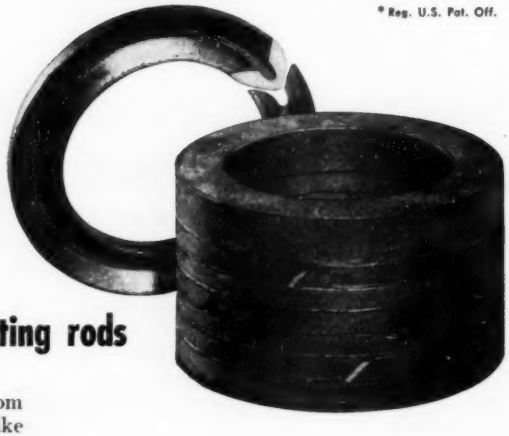
Service Reports Show that

GARLOCK CHEVRON*

* Reg. U.S. Pat. Off.

SEALS BETTER, LASTS LONGER

than ordinary V-type packings on rams, plungers and reciprocating rods



GARLOCK CHEVRON Packing is entirely different from an ordinary V-type packing. Its distinctive hinge-like construction provides greater flexibility without loss of strength and results in a quicker, positive automatic sealing action.

With increasing pressures Chevron rings tighten and prevent leakage; with decreasing pressures the packing eases off and permits operation with a minimum of friction.

Service reports, such as those at the right, prove that Chevron seals better, needs less maintenance, and lasts longer.

For general applications specify 430 CHEVRON for cold and warm water service; 431 CHEVRON for cold and warm oil; 530 CHEVRON for steam, air or gas; 531 CHEVRON for hot oil. For special applications GARLOCK CHEVRON is made of "Teflon" and other special materials.

Typical CHEVRON Service Reports:

- Oil hydraulic presses packed with ordinary V-type packing. Due to oil seepage down ram special hoods had to be installed to protect operators. Installed all-synthetic rubber type Chevron alternated with Garlock Bitan V leathers. Result-rams are perfectly dry and protective hoods have been removed.
- Boiler feed pump in state institution. Operates average of 6 hours per day—365 days per year pumping water at 212-220 deg. F., 170 psi, discharge, 15 ft. head positive suction. Packed with Garlock 430 Chevron in 1942. Packing still operating efficiently.
- Reciprocating pumps in pipe line pumping stations. Pressures up to 700 psi. Stuffing boxes bushed to shallower depth as only four Chevron packing rings required to handle work performed previously by a much greater number of ordinary packing rings. Maintenance men very pleased with long life of Chevron packing and particularly lack of need for gland adjustment for changes of gravity in the crude oil being pumped.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS

Manufacturers who want to influence buyers of power-field equipment find far more readers, far more individual readership, at far less coverage cost in ***Power*** . . . BUYERS looking for SELLERS find them in ***Power***'s Buyers Guide, the only directory of Power-field equipment manufacturers.

The BUYERS' GUIDE (where buyers look for sellers) is coming June 15th, closing for ads May 16th.

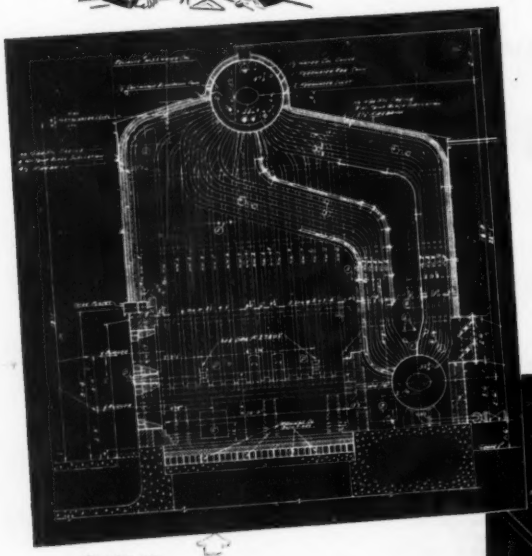
If you want to move a product, put Power behind it

Industry Approved

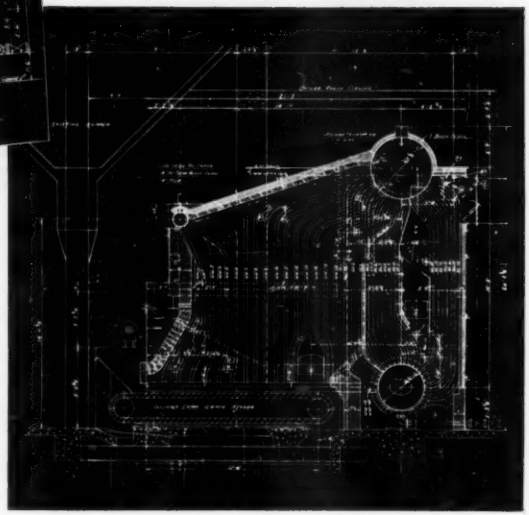
Two-Drum

STEAM GENERATORS

by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 50,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

Typical Users...

FOOD PROCESSING PLANTS

DISTILLERIES • HOTELS

HOSPITALS • CHEMICAL PLANTS

PETROLEUM REFINERIES

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

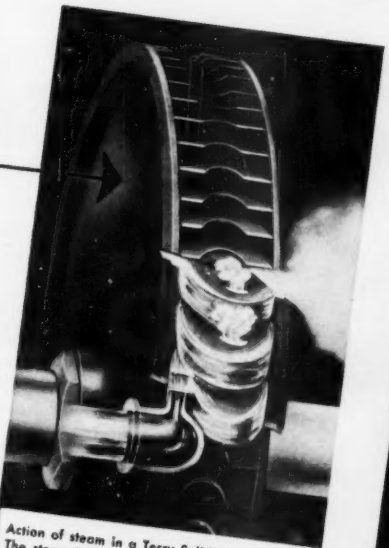
TERRY

THIS TURBINE WHEEL

has no parts to loosen or work out

The rotor of the Terry Solid-wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Hence, wear of the blades is of little consequence, as it does not materially affect horsepower or efficiency. There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to shaft.



Action of steam in a Terry Solid-wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

This is only a small part of the story of the many advantages of the Terry Solid-wheel Turbine. Write for complete details.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

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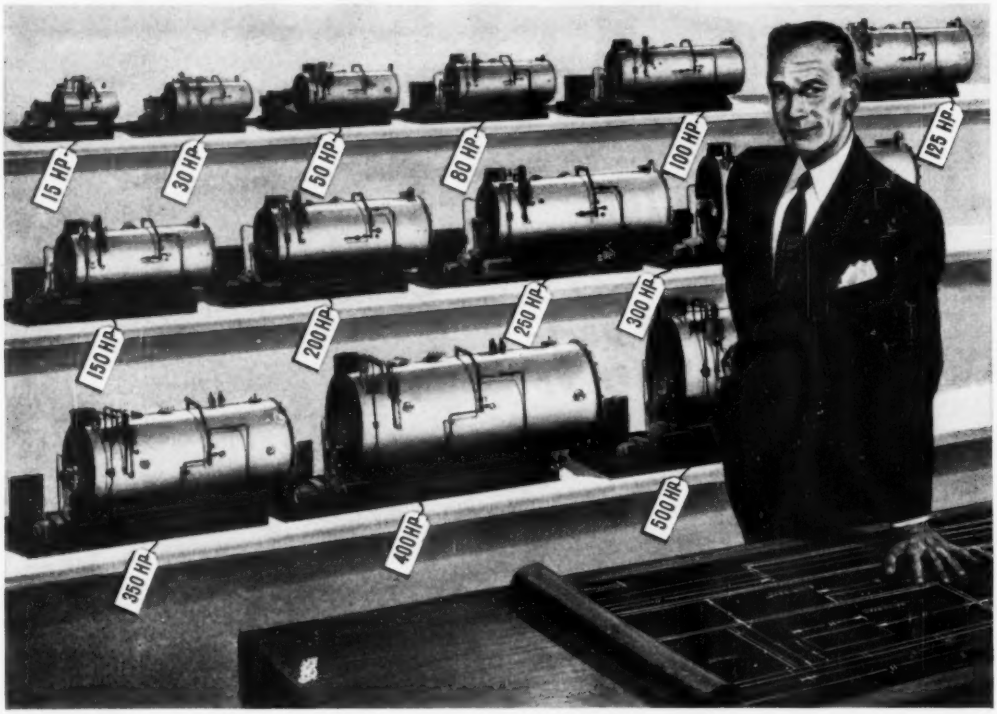
Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Selecting The Right Boiler Is Most Important...

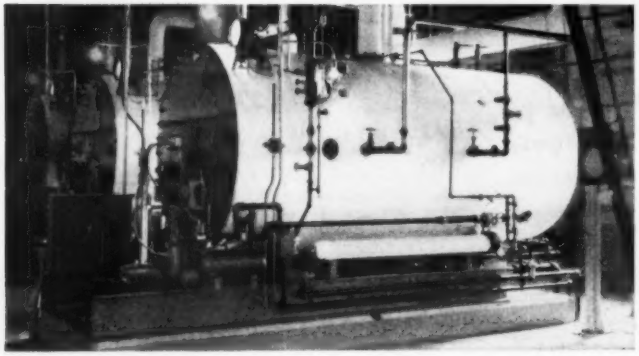


Cleaver-Brooks does not sell steam boilers "off the shelf" even though the boilers are available in standard models. Working with you, your engineers, and your consulting engineers Cleaver-Brooks helps analyze your particular steam needs and loads, both present and future.

These are a few of many factors considered: steam requirements in pounds per hour or b.h.p. — constant or fluctuating loads — fuels available — electric current characteristics — space and boiler room layout — provision for expansion.

Application engineering assistance of this kind assures you a steam plant tailored for your job. Cleaver-Brooks are the first and finest in modern, self-contained steam boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 200 p.s.i.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.



Cleaver-Brooks

STEAM BOILERS

CLEAVER-BROOKS COMPANY
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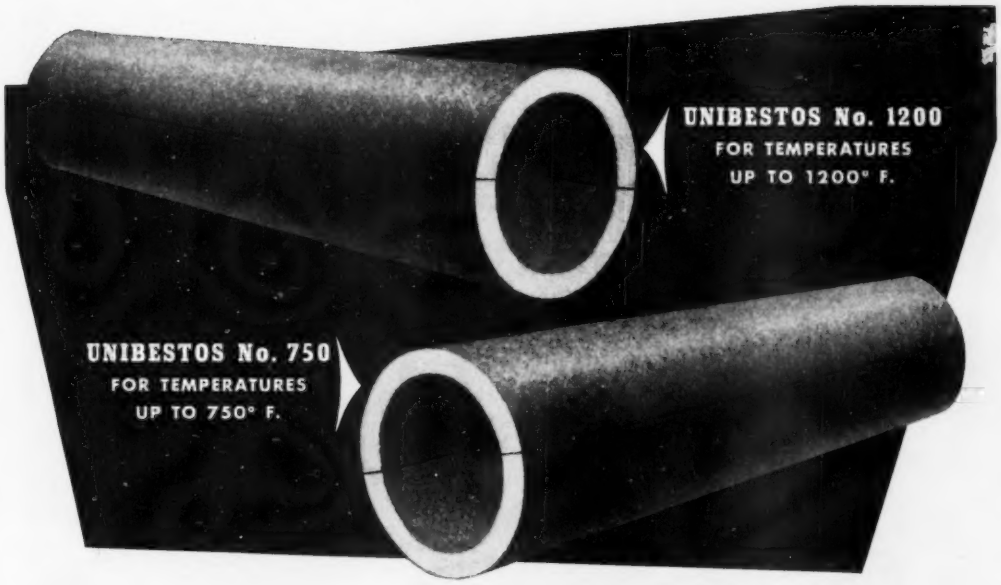
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners



These famous UNIBESTOS twins cut heat loss and surface temperature

HIGH EFFICIENCY IS UNIMPAIRED BY REUSE OR CONTINUOUS SERVICE

When you insulate with Unibestos you can be sure of *prolonged* effectiveness, for this durable African Amosite product resists all service hazards. It's unaffected by moisture, steam, fumes . . . withstands impact and vibration . . . won't shatter, crumble, powder, or dust to contaminate the atmosphere under normal service conditions.

Unibestos is easy to cut and fit . . . brings you the added economy of *single-layer* application . . . may be removed and reused repeatedly without damage or loss of efficiency. Adjacent sections can be stapled together to prevent separation due to expansion.

Phone your Unarco Distributor for *money-saving* Unibestos in cylinders, half-rounds, or blocks.

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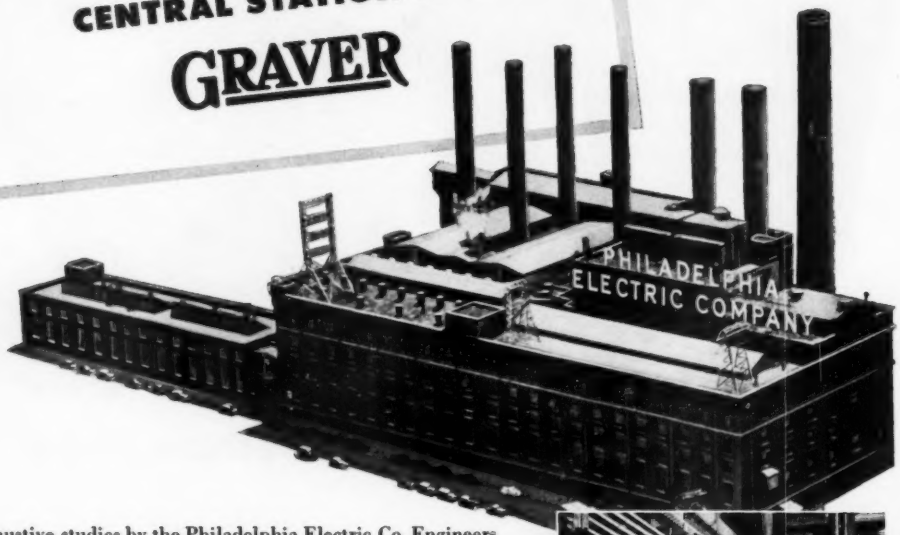
The Largest Demineralizer

USED IN A PUBLIC UTILITY CENTRAL STATION IS A GRAVER



Exhaustive studies by the Philadelphia Electric Co. Engineers of all water purifying methods and equipment designs led to the selection of a Graver Demineralizing plant for the Schuylkill Station.

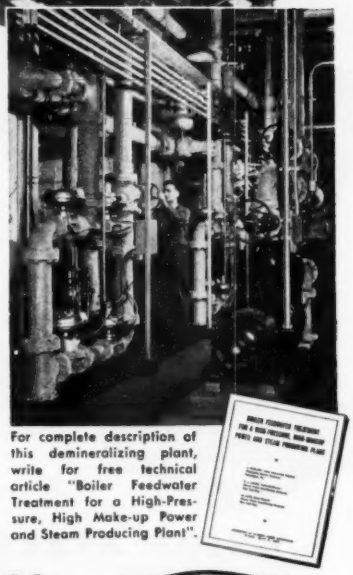
The requirements . . . . . boiler feed make-up 1250 gpm for 1250 psig boilers.

The purpose . . . to supply heating needs in downtown Philadelphia, serving 600,000 lb per hr make-up to high pressure boilers and topping turbines.

The Graver plant has been in operation since late 1950. Typical of Graver performance and guarantees are the following results:

	Raw Water	Graver Guarantee	Graver Performance
Dissolved Solids, ppm	**220**	**less than 8**	**1.5-2.0**
Silica, ppm	**13**	**less than 0.3**	**0-0.2**

Doing better than expected is a Graver habit . . . demonstrated by all types and sizes of Graver Water treatment plants. To make sure that *you* have "better than expected" results, consult Graver about *your* water problem.



For complete description of this demineralizing plant, write for free technical article "Boiler Feedwater Treatment for a High-Pressure, High Make-up Power and Steam Producing Plant".

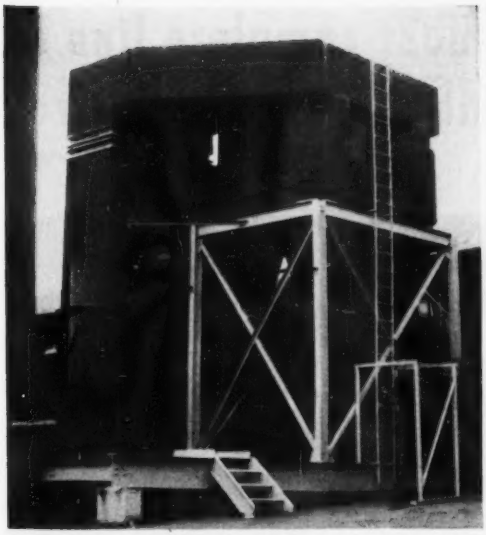
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14TH STREET, NEW YORK 11, N.Y.

GRAVER

GW 490



After an exhaustive study, engineers at a Southern paper mill selected Buell van Tongeren Cyclones for their three pulverized-coal-fired boilers.

How to Keep Stack Dust Down Now

● *This industrial 'dust' man can help determine the Dust Abatement System most efficient for you!*

The Buell organization of industrial 'dust' men is devoted solely to the design and construction of dust collection equipment that will most efficiently and economically solve your plant's specific Stack Dust problem.

For more than 18 years we have been doing just this for all American industry. Every Buell installation is a custom-designed system, engineered to hold stack dust discharge down to the practical limits which assure new profits, improved product and/or process, better plant-community relations, higher levels of employee morale.

For full information about Buell's ***3 basic systems*** of dust collection, and how one can be applied to the solution of your stack dust problems, write today. Ask for the new, informative bulletin titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 50-C, 70 Pine Street, New York 5, N. Y.

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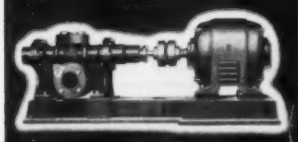
SPECIAL PURPOSE COLLECTORS • DUST HOPPER VALVES

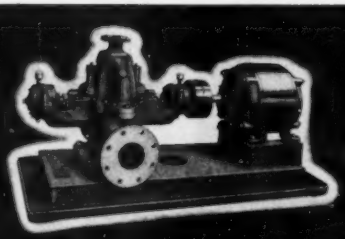
ENGINEERED EFFICIENCY IN DUST COLLECTION

WARREN...the most complete line of industrial pumps available from one source

CENTRIFUGAL • RECIPROCATING • SCREW • ROTARY

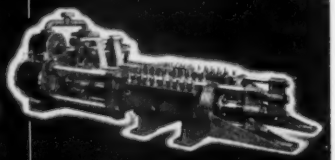
Warren-Quimby Gear-in head Screw Pump

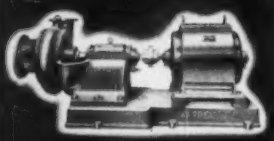




Warren Condensate Pump

Warren Horizontal Duplex Hydraulic Pump



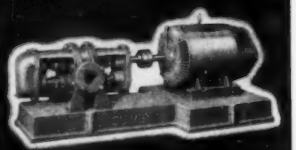


Warren Type "L" Single-Stage Single-Suction Liquor Pump

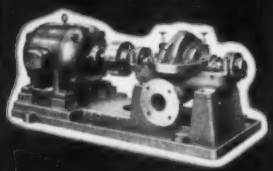
There's a Warren or Warren-Quimby Pump for practically all industrial pumping applications, and our large variety of types and sizes assures an unbiased recommendation. The value of this should not be underestimated because a recommendation that barely meets operating conditions and requirements can prove to be anything but a profitable long range investment, regardless of any initial advantage in cost.

It will pay you to check with Warren on your next pumping job.

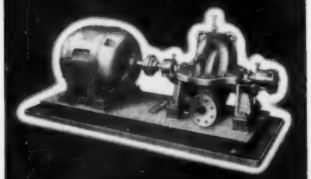
P-57



Warren-Quimby External Gear and Bearing Rotex Pump



Warren Type DBL, Single-Stage Double Suction, Centrifugal Pump



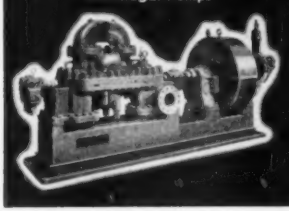
Warren Two-Stage Volute Centrifugal Pump

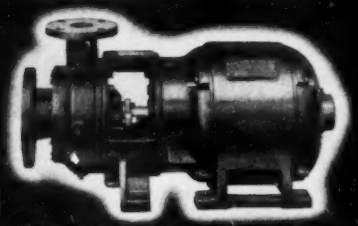
WARREN QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC.

WARREN, MASSACHUSETTS

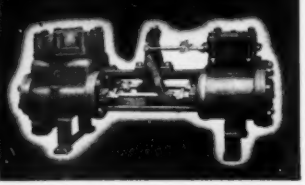
Warren 4- and 6-Stage Centrifugal Pumps

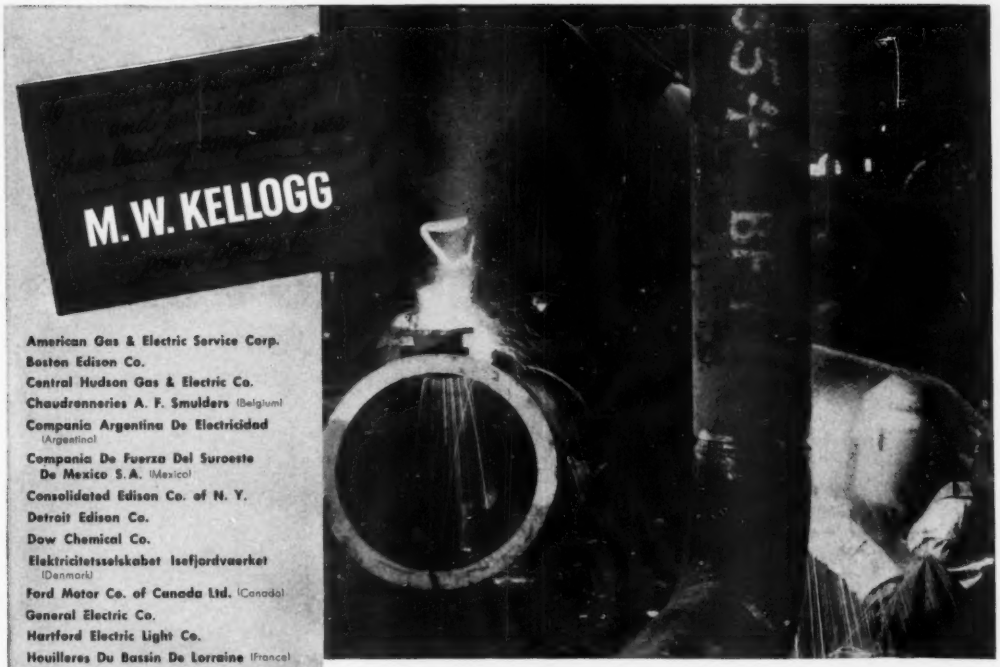




Warren "Compacunit"—4 Types—42 Sizes

Warren Horizontal "Realwear" Duplex Piston Pump





American Gas & Electric Service Corp.
Boston Edison Co.
Central Hudson Gas & Electric Co.
Chaudronneries A. F. Smulders (Belgium)
Compania Argentina De Electricidad (Argentina)
Compania De Fuerza Del Suroeste De Mexico S.A. (Mexico)
Consolidated Edison Co. of N. Y.
Detroit Edison Co.
Dow Chemical Co.
Elektricitetsselskabet Isefjordvaerket (Denmark)
Ford Motor Co. of Canada Ltd. (Canada)
General Electric Co.
Hartford Electric Light Co.
Houilleres Du Bassin De Lorraine (France)
Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
Hydro-Electric Power Commission of Ontario (Canada)
Indiana & Michigan Electric Co.
Interbrabant (Belgium)
Long Island Lighting Co.
Metropolitan Edison Co.
Mexican Light & Power Co. (Mexico)
Monongahela Power Co.
New York State Electric & Gas Corp.
Niagara Mohawk Power Corp.
Palestine Electric Corp., Ltd. (Israel)
Philadelphia Electric Co.
Public Service Co. of Northern Illinois
Public Service Electric & Gas Co. of N. J.
Societe Anonyme John Cockerill (Belgium)
Societa Edison (Italy)
Societe Financiere De Transports Et D'Entreprises Industrielles (Sofina) (Belgium)
Societa Meridionale Di Elettricita (Italy)
Sociedad De Electricidad De Rosario (Argentina)
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United Illuminating Co.
Westinghouse Electric Corp.
West Penn Power Co.
Wisconsin Public Service Corp.

KELLOGG

This kind of welding stands up under 1100F and 2350 PSIG . . . *because*—

When these welders in Kellogg's Jersey City fabricating shops strike their arcs in welding high-temperature, high-pressure power piping for a modern steam-powered central utility station, their expertness is backed by much more than personal know-how.

The beads they lay can be counted on to stand up because of the outstanding amount of welding technology acquired by Kellogg during the three decades it has been servicing this vital industry. From carbon steel, through low alloy steel, to stainless steels for handling temperatures now exceeding 1100 F and pressures of 2350 psig, Kellogg has fabricated literally miles of this critical equipment. These welders can call on the knowledge gained in more than 160,000 man-hours spent just in welding alloy piping alone.

They have behind them one of the most complete metallurgical laboratories in the country . . . a special welding-technique development section . . . experience gathered in collaborative research with the leading turbine, boiler and steel manufacturers of the country . . . the most up-to-date non-destructive testing equipment available.

It is because of such men and their firm technological backing, that Kellogg is specified again and again by important power companies for critical power piping jobs all over the world.

OTHER FABRICATED PRODUCTS including:
Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Giant One-Piece Bends . . . Forged and Welded Fittings . . . Radial Brick Chimneys

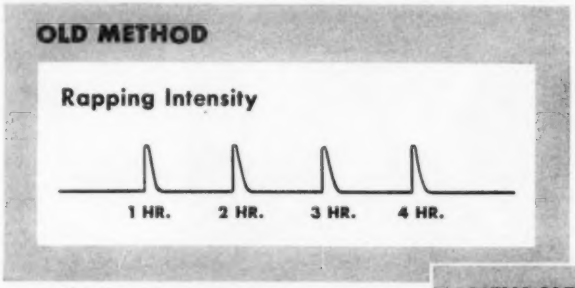
for 51 years an integral part of industrial progress!

The M. W. Kellogg Company (A Subsidiary of Pullman Incorporated)
Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

New Development

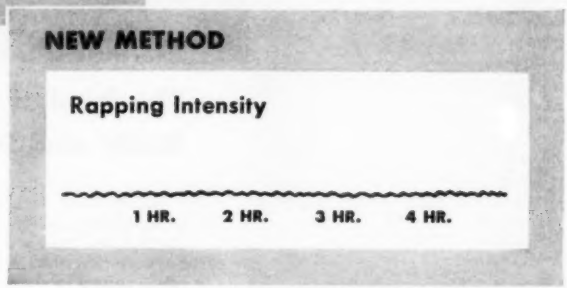
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

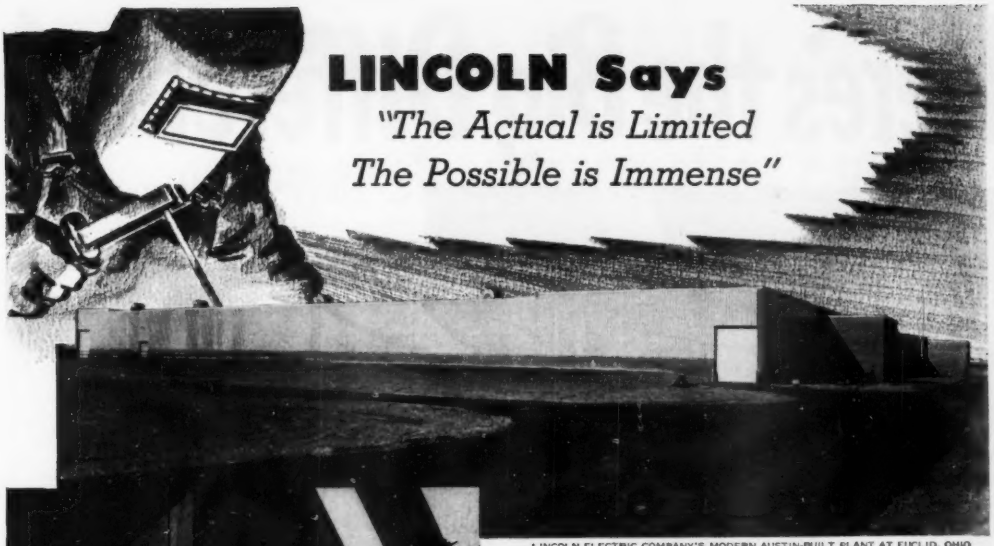
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

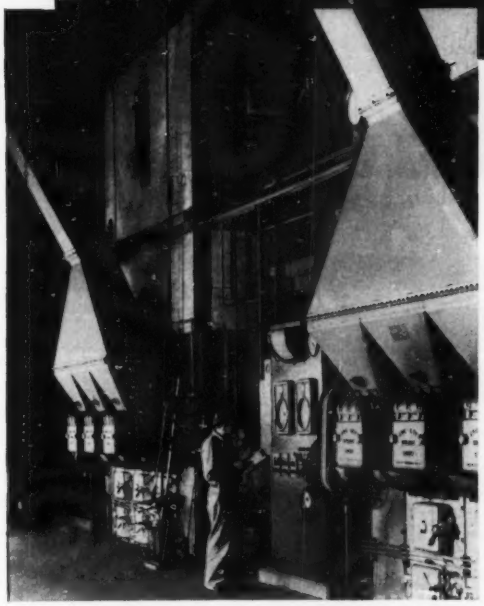
RC-131

LINCOLN Says

"The Actual is Limited
The Possible is Immense"



LINCOLN ELECTRIC COMPANY'S MODERN AUSTIN-BUILT PLANT AT EUCLID, OHIO



BOILER and STOKER DATA

BOILERS	2-ERIE CITY 2-DRUM (550 hp.)
CAPACITY	38,000 pounds STEAM per hour
DESIGN PRESSURE	160 lbs.
FIRING EQUIPMENT	2-ERIE CITY DUMPING GRATE SPREADER STOKERS
FUEL	OHIO BITUMINOUS

We Agree - Here's Why

Erie City Iron Works is proud to have Erie City Boilers and Stokers installed in Lincoln Electric Company's modern Austin-built plant at Euclid, Ohio.

As the oldest boiler builder in America, we well remember when the "Actual" in the Lincoln motto seemed to us to be "limited" by the skill of the riveter. Today, thanks to the great advance in welding science, we find "Possibilities Immense." Today, Lincoln welded seams are routine in all Erie City Boilers, and former potential trouble points are transformed into the strongest parts of the boiler shell.

There's a modern Erie City Boiler to meet any steam demand. Outline your requirements.

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Here's the Big Difference!

TAPER-LOCK

–The Sheave that always runs true!

The Taper-Lock bushing seats evenly along the entire length of the hub. It is self-seating. There is no collar—no protruding part—no flange to prevent uniform compression.

With full contact, Taper-Lock sheaves run true. Made of finest grade of close-grained semi-steel, cast in the Dodge foundry. Precision grooves have identical pitch diameters so that every belt can pull its share of the load.

Sheave and bushing mount as a unit—easy to align on the shaft. Grips the shaft like a shrunk-on fit. Flush hub means safety.

THERE IS ONLY ONE TAPER-LOCK (a patented product of Dodge). Available from distributors' stocks in a complete range of sizes in A-B combination, B, C and D grooves. Also ask your distributors for Dodge Sealed-Life V-Belts. WRITE for complete data.

DODGE MANUFACTURING CORPORATION, 3200 Union St., Mishawaka, Indiana

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

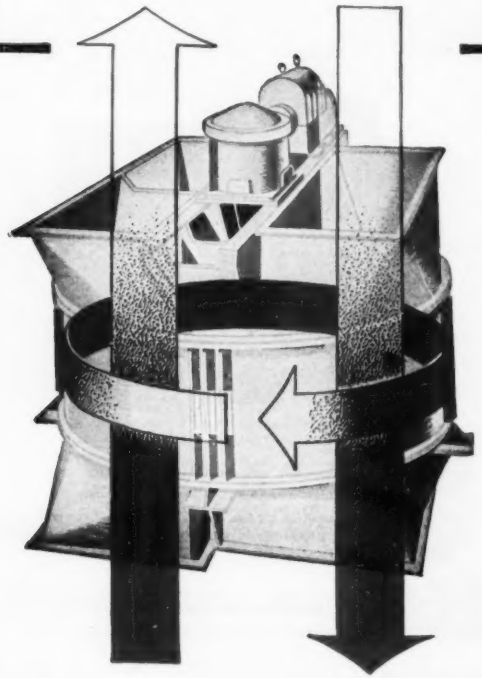
your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified phone book.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

more than 285,000,000 lb/hr of post-war steam generating capacity

equipped with *Ljungstrom*

AIR PREHEATERS



Here indeed is impressive evidence of the wide acceptance of the Ljungstrom air preheater. Since the war the total capacity of steam generating units equipped with Ljungstrom air preheaters, installed, under construction or on order in industrial and utility plants throughout the country comes to well over 285,000,000 pounds of steam per hour.

The reasons for the steadily increasing preference for the Ljungstrom air preheater are simple enough. The continuous regenerative counterflow principle assures maximum heat transfer with minimum weight and size. Flexible and compact, it may be used in a wide range of applications. Its proven reliability and low maintenance eliminate costly shutdowns.

If you are planning to build a new plant or modernize an old one, investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid in effecting the most economic heat recovery from flue gases.

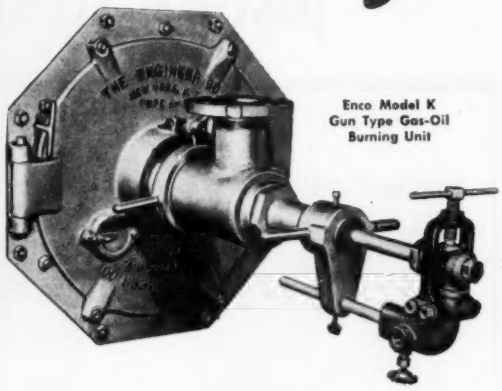
The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42d STREET • NEW YORK 17, NEW YORK

flexible... 3 ways

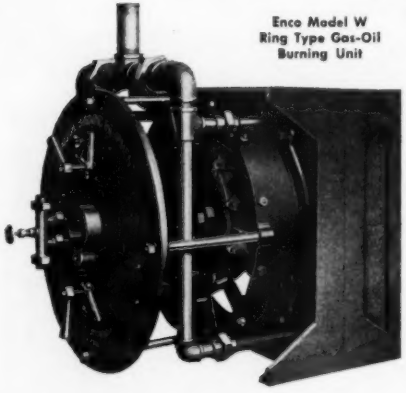
ENCO
OIL AND GAS BURNER UNITS



Enco Model K
Gun Type Gas-Oil
Burning Unit

These specially designed oil and gas burner units fit your needs . . . even when your operating conditions keep changing. Enco Oil and Gas Burner Units offer money-saving flexibility on three important counts. (1) They are designed for use with either oil or gas — or both . (2) They assure completely uniform combustion and greater fuel economy though steam demands swing sharply. (3) They can be operated by either natural or forced draft.

Even if your old combustion equipment "works", it pays to investigate the fuel-saving economies and full flexibility of these highly efficient units. Enco Burner Units are made in many sizes to suit all capacity requirements. Bulletin on request.



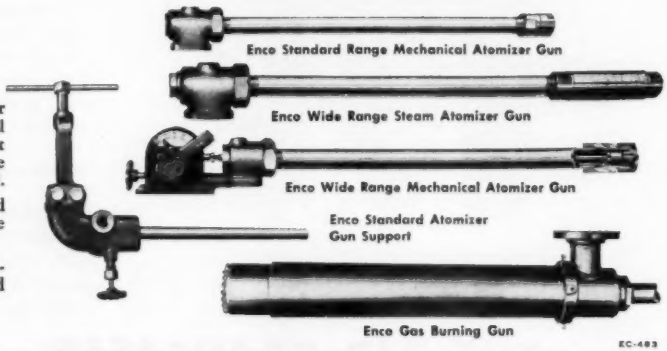
Enco Model W
Ring Type Gas-Oil
Burning Unit

ENCO
INTERCHANGEABLE ATOMIZERS
FOR USE WITH ALL TYPES OF BURNER EQUIPMENT

Wide Range Mechanical—Manual or automatic control. Constant high oil pressure at atomizer insures efficient atomization over entire load range without recirculating or returning oil.

Steam or Air—Wide range. Controlled by manual or automatic pressure regulation.

Standard Range Mechanical — Available in all sizes to suit load and capacity requirements.



Enco Standard Range Mechanical Atomizer Gun

Enco Wide Range Steam Atomizer Gun

Enco Wide Range Mechanical Atomizer Gun

Enco Standard Atomizer Gun Support

Enco Gas Burning Gun

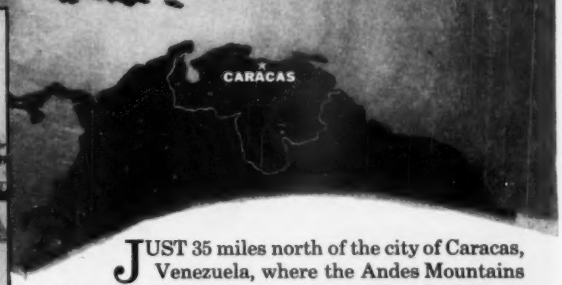
EC-483

THE ENGINEER COMPANY 75 WEST STREET, NEW YORK 6, NEW YORK

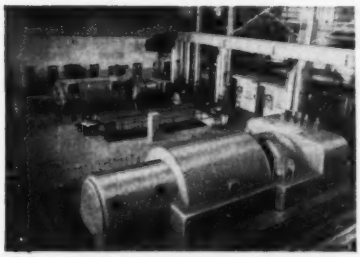
IN CANADA: F. J. RASKIN, LTD., 4220 IBERVILLE ST., MONTREAL 34 P.Q.

More Power to South America

from Pritchard



JUST 35 miles north of the city of Caracas, Venezuela, where the Andes Mountains rise from the Carribean, a new, modern building is nestled in a small valley on the seacoast. This building contains a *40,000 kilowatt* steam electric power station which ties into the distribution system serving the industrial and residential needs of the Federal District of Venezuela.



Interior of the 40,000 kw. steam electric power station designed and built by J. F. Pritchard & Co. near Caracas, Venezuela.

Designed, engineered and constructed by Pritchard, the Arrecifes Power Station of C.A., La Electricidad de Caracas, has boilers, turbines and all auxiliary equipment arranged for unit system operation without cross connection. This installation is another fine example of the many outstanding Pritchard-built plants that are providing maximum efficiency at lowest cost.

Whether *your* need is for a complete new plant, alterations or expansion, Pritchard provides the sound design, engineering and construction services that pay off in operational efficiency and trouble-free service. Your inquiry is invited.

Chemical Division
Power Division
Petroleum Division
Natural Gas Division

For Complete Information, Write

NATIONAL INSTRUCTORS ASSOCIATION — MEMBER

J.F. Pritchard & Co.

DESIGN · ENGINEERING · CONSTRUCTION

Dept. No. 211 — 908 Grand Ave., Kansas City 6, Mo.

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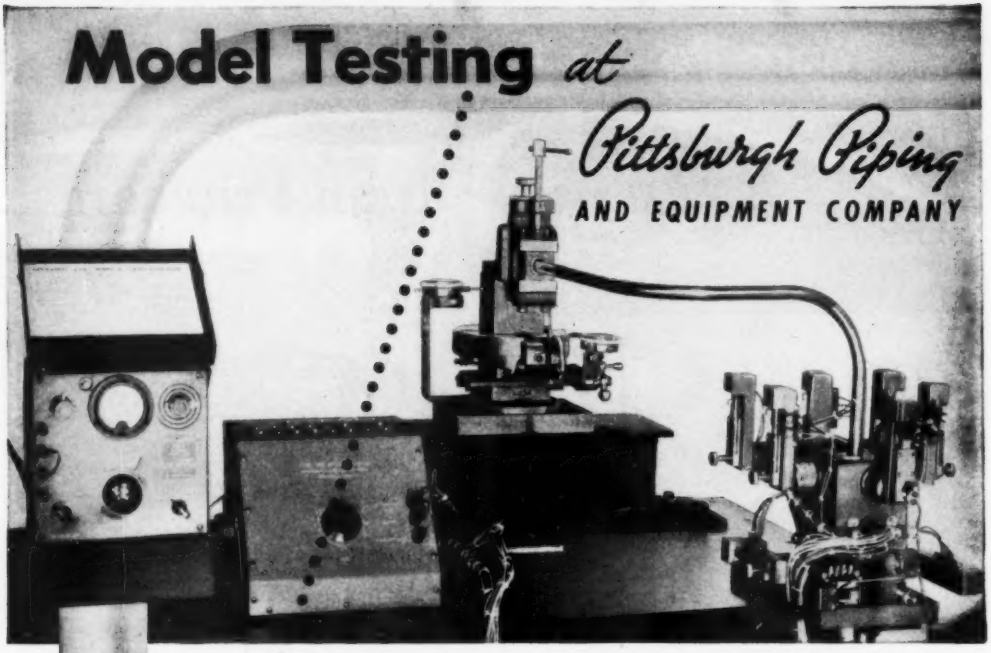
Model Testing at Pittsburgh Piping AND EQUIPMENT COMPANY



The Modern Method for Complete, Practical Pre-determination of Piping Flexibility

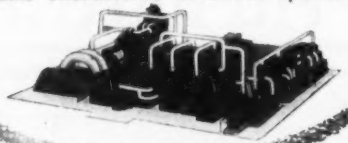
Model testing is one of the many technological advancements thoroughly investigated and proved by Pittsburgh Piping and Equipment Company before being made generally available. It provides complete advance knowledge of the reactions of any type, size, and system of power piping.

The testing apparatus shown above accurately measures and directly indicates the physical reactions of a section of pipe which exactly duplicates, in miniature, the planned layout. These measurements are projected to give precise information on the full size system as a check against theoretical calculations.

On complex piping layouts, model testing provides a complete analysis instead of theoretical approximation; it is a time and labor saver; and the possibility of mathematical error is minimized. Its use helps to avoid excessive stresses, reactions, and movements in the final system which could affect joints and thus cause leakage, or damage anchors and equipment connected to the pipe line.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

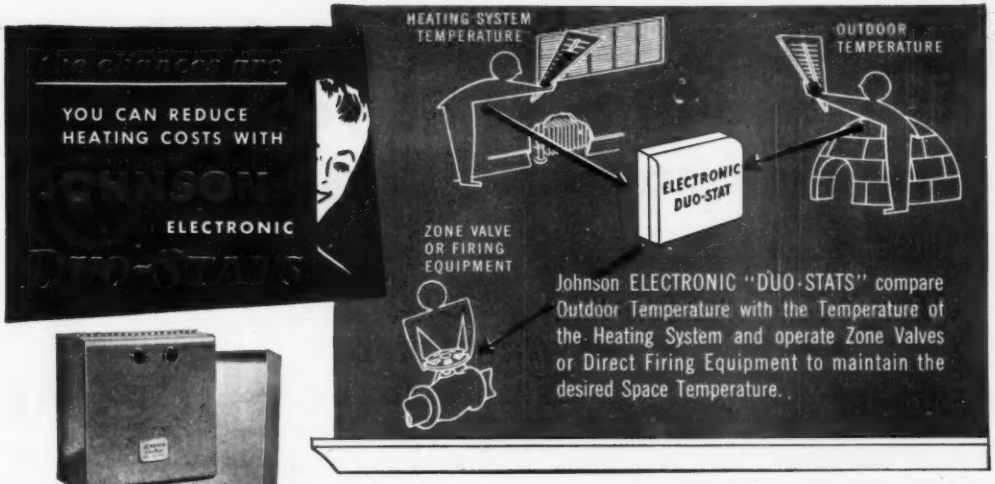
Model Testing makes possible the planning of high-pressure, high temperature piping systems with accurate advance knowledge of end reactions, stresses, and strains encountered in actual operation.



Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston



2 NEW AND IMPROVED MODELS

T-385 Standard Model Electronic Duo-Stat: Complete with indicating lights and 3-position manual switch, "Off-Auto Control-On."

T-386 Clock Model Electronic Duo-Stat: Available with either 24-hour or 7-day program clock. Complete with indicating lights and 5-position manual switch. "Off-Nite-Clock-Day-On."

CHANGE THE SIZE OF THE HEATING SYSTEM

. . . TO FIT THE WEATHER

IN ALL TYPES OF BUILDINGS

The Johnson Electronic *Duo-Stat*, pioneer in the field of electronic controllers, employs an accurate dependable resistance circuit, together with a sensitive, yet rugged, amplifying mechanism. Johnson Electronic *Duo-Stats* have been in successful operation in all types of buildings, and applied to all types of heating systems, over a period of twelve years. Fuel savings which have resulted, coupled with the unique operational features afforded by Electronic *Duo-Stats*, prompted the design of these two, new and improved models.

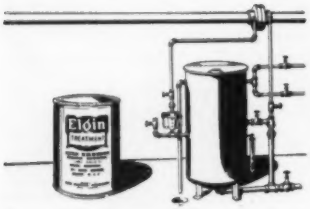
These precision "weather-compensated" heat controllers are designed for universal application to heating systems of every type, in all kinds of buildings. In every case, the *Duo-Stat* supplies exactly the right amount of heat to compensate for changes in outdoor conditions.

Ask a Johnson engineer from a nearby branch office for recommendations on any temperature control problem—large or small—in both new and existing buildings. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

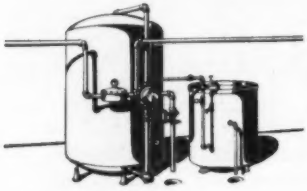
MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

Which of these methods will best fit your water conditioning needs?



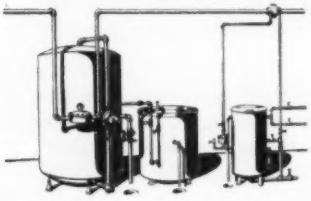
1 CHEMICAL FEED

In many cases, individually prepared Elgin Chemical Treatment alone will effectively prevent scale formation and corrosion.



2 ZEOLITE SOFTENING

A zeolite water softener will efficiently eliminate hardness, scale, and lime deposits.



3 ZEOLITE — POST TREATMENT

A zeolite softener, supplemented by chemical treatment will not only eliminate hardness, but will also prevent corrosion.

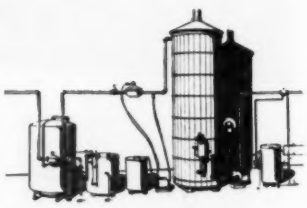
FOR AN UNBIASED ANSWER . . . CALL YOUR ELGIN MAN

Chances are that one of these basic Elgin systems will fit your water conditioning needs. If not, there is no limit to the number of systems we can "tailor" to your exact requirements and budget.

Whether a simple chemical feed system, a zeolite water softener, one of the many ion-exchange combinations, silica and CO_2 removal, or deionization for the highest quality water known today — you may be sure Elgin can provide the type of system required to produce water of the exact characteristics you require.

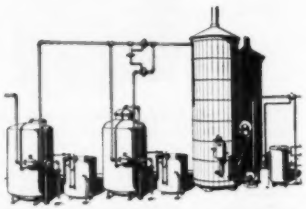
Nearly a half century of water conditioning experience is yours for the asking

Most important is the fact that Elgin's skill and experience, gained through nearly a half century devoted exclusively to the field of water conditioning, is yours for the asking — through our district engineer in your vicinity. Write, wire or phone, and we will put him in touch with you.



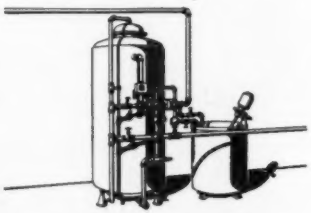
4 ZEOLITE — ALKALINITY NEUTRALIZATION

Water of low-controlled alkalinity, with CO_2 removed, can be produced by acid feed and degasification following zeolite softening.



5 SODIUM — HYDROGEN SOFTENING AND DEGASIFICATION

Blended effluents from a sodium zeolite softener and a hydrogen zeolite softener, followed by degasification, give water in which total solids and alkalinity is reduced and CO_2 is removed.



6 DEIONIZATION INCLUDING SILICA AND CO_2 REMOVAL

Single-tank Ultra-Deionizer produces the equivalent of distilled water, free from silica and CO_2, at amazingly low cost.

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POINTING the WAY
To Continuing Prosperity

The set of figures in the middle of this page is news of high importance to every American.

In effect, it says that there is no basis in fact for all this talk about a collapse of capital expenditures plunging us into a depression following the industrial build-up for defense.

Such talk assumes that without defense orders business would spend relatively little for new industrial plant and equipment. The figures below show that that assumption is not justified.

penditures in 1953, 1954 and 1955, provided the money to carry them out can be obtained.

A Record in '52

As was expected, their plans call for another record-breaking volume of capital expenditures by business in 1952. But, as many did not expect, the McGraw-Hill survey also discloses plans for very heavy capital expenditures in each of the three years following. Expenditures now planned for those years are, to be sure, lower than those planned for 1952. But the significant fact is not that

BUSINESS PLANS FOR NEW PLANTS AND EQUIPMENT (Millions of Dollars)

	Actual Spending 1950*	Actual Spending 1951*	McGraw-Hill Survey			
			Planned	— Preliminary Plans —		
			1952	1953	1954	1955
Manufacturing	7,491	11,141	12,921	10,028	8,525	8,194
Mining	684	806	943	415	321	358
Railroads	1,136	1,564	1,642	1,248	1,117	1,002
Electric & Gas Utilities**	3,298	3,676	3,948	3,360	3,204	2,748
Other Transportation & Communications	1,392	1,592	1,721	1,671	1,943	1,839
ALL INDUSTRY	14,001	18,779	21,175	16,722	15,110	14,141

*U. S. Department of Commerce
**Electrical World (A McGraw-Hill publication) and American Gas Association.

The figures come from the fifth annual McGraw-Hill survey of business plans for new plant and equipment. Companies were asked to report through that survey not only their plans for 1952, but plans they now have in hand for capital ex-

they are lower. Experience shows that plans made several years ahead always overlook many expenditures that are needed later.

The significant fact is that the expenditures already planned for 1953-55 are so high. For example,

those now planned for 1955 would be higher than those of 1950, which, at that time, were second highest in our history.

If these plans are carried out we shall have an essential element of continuing prosperity. Sustained expenditures for capital expansion and betterment account directly for a large share of our employment and consumer income. Moreover, consistent modernization of industrial plant raises production efficiency and brings more and better goods and services within reach of more consumers.

It is not to be expected, of course, that we can come down from the peak of the defense boom without readjustments in some sectors of business. But if capital expenditures by business are carried out on the scale now planned, we shall be able to take any necessary readjustments in our stride, and continue to increase our industrial strength.

From V-J Day to the end of this year, manufacturing industries will have spent over $60 billion for new industrial plant and equipment. This is more than the value of all the plant and equipment these industries had on their books at the end of World War II. It is this heavy outlay that causes some, assuming most postwar plans for industrial expansion and modernization will be completed, to fear a collapse of capital expenditure.

Plans to Go Ahead

But American industry still has plans to go right ahead expanding and improving its facilities. This was the most striking single finding of this year's survey.* It disclosed also that after 1952:

— 83 per cent of the companies answering the survey are planning substantial further modernization.

— 48 per cent will need more capacity to make their present products.

— 33 per cent plan additional capacity to make new products.

It cannot be too strongly emphasized, however, that these plans represent what American industry *wants* to do. They are a concrete expression of hope and aspiration. As such they are extremely important, for they dispose of the idea that business considers the job of expanding and improving its facilities as finished, or anywhere near finished.

But the plans carry no guarantee of accomplishment. If they are to be realized, business must have the funds to carry them out. There is no assurance that the money will be available if the present level of corporation taxes is continued. Eight out of ten companies, according to the McGraw-Hill survey, will rely entirely on profits and reserves to finance their 1953-55 programs. So, in calculating their programs for these years, the companies were asked to assume relief from "excess profits" taxation.

Federal taxes now take at least 52 per cent of a corporation's profits, and 82 per cent of any profits in the so-called "excess profits" bracket. Despite this drain on their funds, companies are able to finance their 1952 programs because (1) they are borrowing heavily, and (2) many of them are getting government loans or special tax concessions on new facilities installed for defense purposes. But these are emergency aids.

Only Two Ways

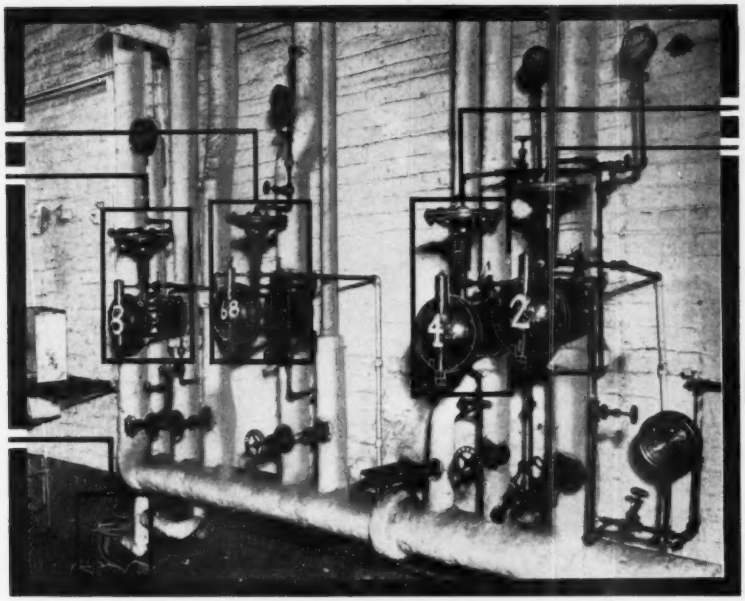
When the present defense program tapers off, there will be only two ways by which business can possibly increase its principal source of funds for new plant and equipment. One way is to make more profits before the tax collector takes his cut. And the only way many companies, already operating at capacity and high efficiency, can do that quickly is by raising their prices. That is an unpopular method. Also, with the return to more competitive markets, it might be self-defeating.

The other way is for the federal government to release its strangle hold on business profits. The so-called "excess profits" tax—the 82 per cent tax which is really a tax on business growth—should be repealed, effective January 1, 1953. And a cut in the basic tax of 52 per cent on all corporate profits should come not much later. That is by all odds the most important single step toward assuring that business plans already made for capital investment in 1953, 1954 and 1955 are carried out. It is the most important single step toward sustaining our present prosperity.

Through its plans for continued expansion and improvement of its facilities, American business clearly points the way to avoid the depression that so many have feared – and the Communists have so ardently hoped – would follow the peak of defense mobilization. It will be a tragedy for our country and for Americans in every walk of life if we do not insist that business get the chance to follow this wise and constructive course.

McGraw-Hill Publishing Company, Inc.

*Note – A copy of the full report of this survey can be obtained by addressing: Department of Economics, McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York 36, N. Y.

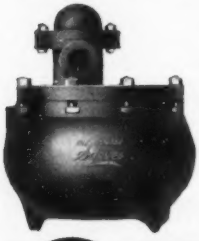


Over 200 Years of Service

without a Major or Costly Replacement

This is the record of achievement for the four SQUIRES Reducing Valves and one SQUIRES Steam Trap as attested by the photograph above. Operating in the plant of the Grabler Manufacturing Company of Cleveland, Ohio, the original installation was made in June of 1907. These five standard units of SQUIRES equipment have been in continuous operation since that date without a major or costly replacement under rugged, demanding working conditions. An individual record for each valve and trap of over 40 years, for a total of over 200 years of continued service.

The low maintenance and record of service is proof of positive, satisfactory performance of SQUIRES Valves and Traps. The trap shown in this installation is draining a line with 125 pounds steam pressure. The Reducing Valves are maintaining a constant delivered pressure of 4 pounds reduced IN ONE STEP REDUCTION from 125 pounds.



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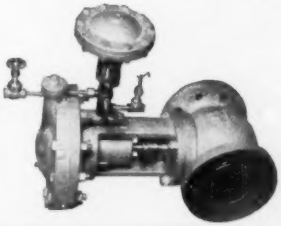

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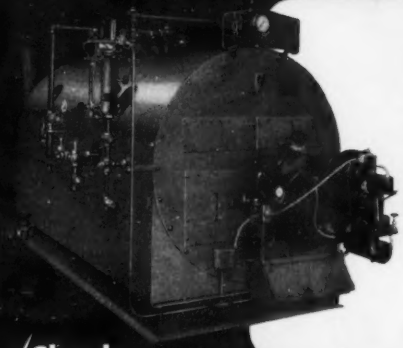

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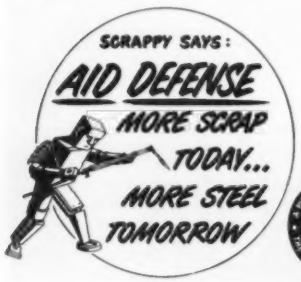
Don't delay—the emergency is becoming more severe every day.

*For every ton of scrap fed into the furnaces, we save approximately 2 tons of iron ore, 1 ton of coal, nearly ½ ton of limestone and many other critical materials. Also, scrap helps make steel faster, shortens the refining process.



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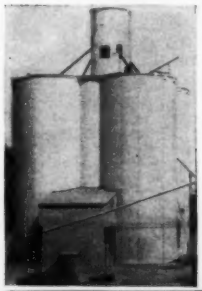

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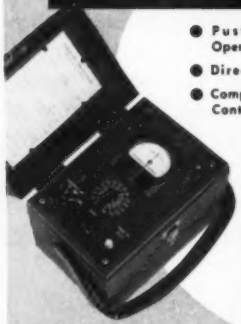

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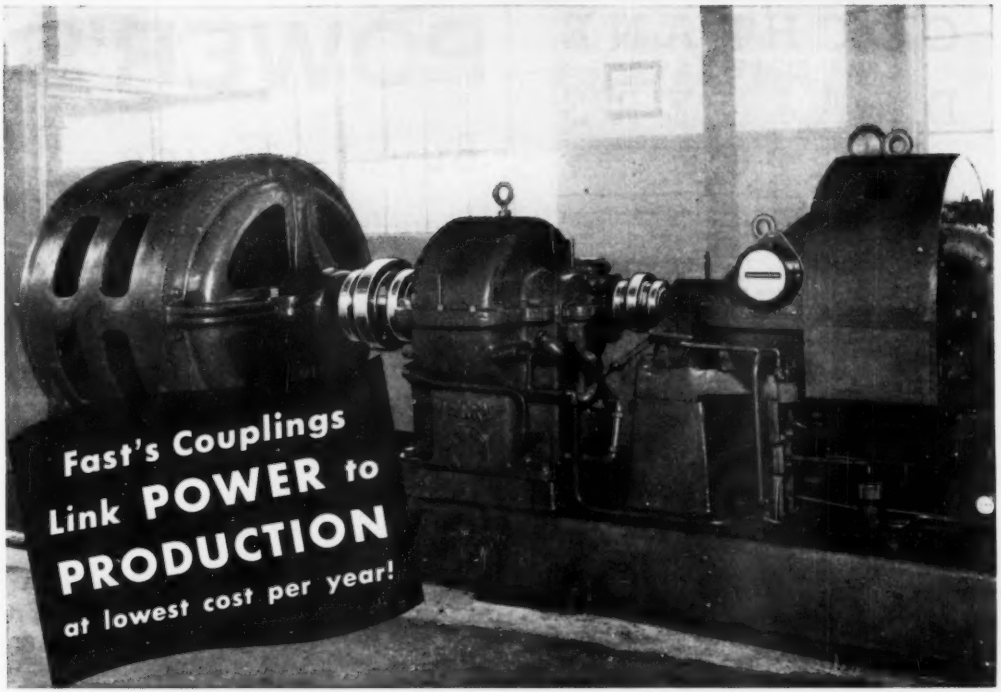

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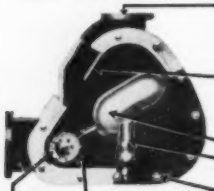

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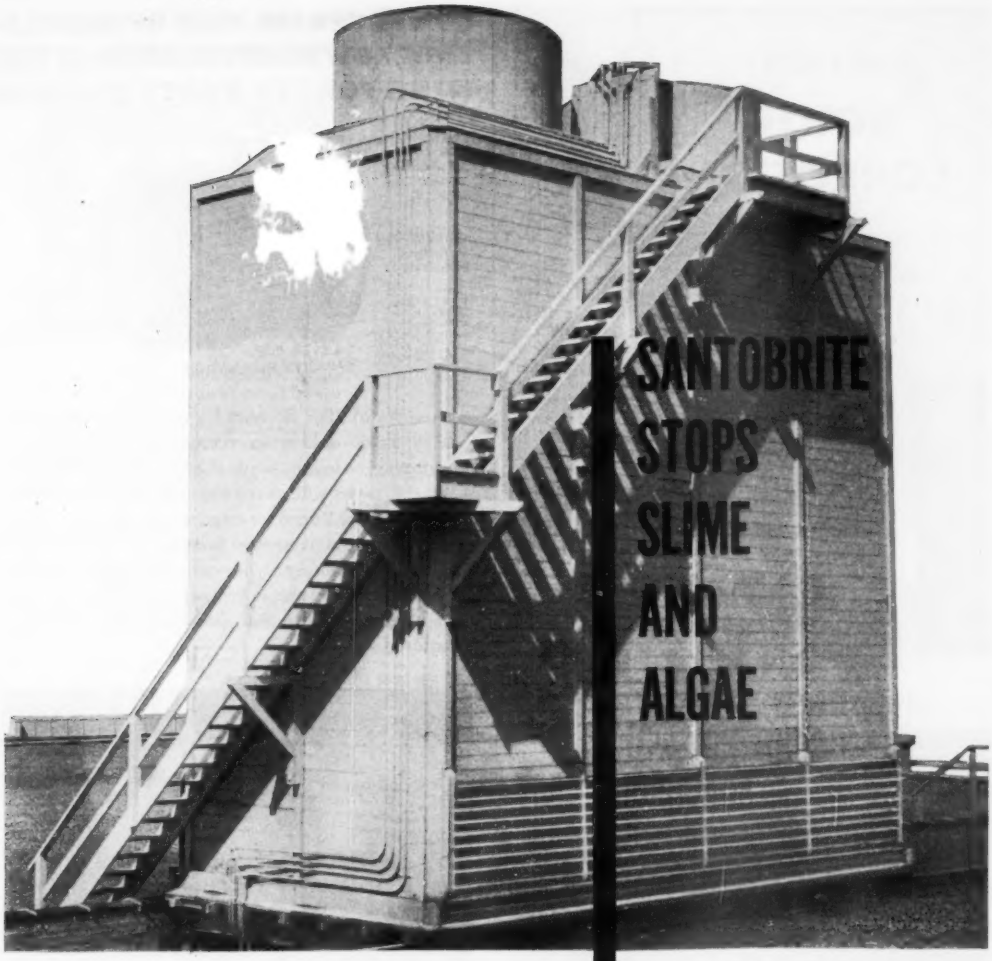

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Oxygen, one very active source of destructive boiler corrosion, is continuously detected and recorded by the Cambridge Gas Analyzer. The oxygen dissolved in the feed water is determined directly, and continuously recorded upon the Cambridge Dissolved Oxygen Recorder. The oxygen set free by dissociation in the boiler is determined by measuring the free hydrogen in the steam which is recorded upon the Cambridge Dissolved Hydrogen Recorder. Cambridge Analyzers are available in models for continuously recording either O_2 or H_2 separately or O_2 and H_2 simultaneously.

Send for Bulletin 148 B.P.

CAMBRIDGE INSTRUMENT CO., INC.

3007 Grand Central Terminal New York 17, N. Y.

CAMBRIDGE

DISSOLVED O_2 & H_2

ANALYZERS

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

"GUNITING" with *Super* ADACHROME-CAST

...SAVES OUTAGE TIME and MONEY

Use **SUPER ADACHROME-CAST** to gunite your stud tube water walls.—Fine-grained to penetrate the small apertures between studs.—packs to a dense mass when shot. One user reports **SUPER ADACHROME-CAST** lasted twice as long and took but one-third the time to apply as compared with a plastic chrome ore installation.

Excellent for coating brickwork when free of slag.

BOTFIELD

Yours, **FREE** for the asking . . . an illustrated, detailed Bulletin on *Super* **ADACHROME-CAST.**

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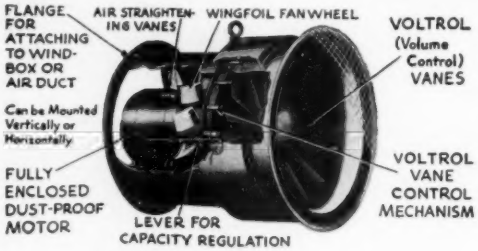
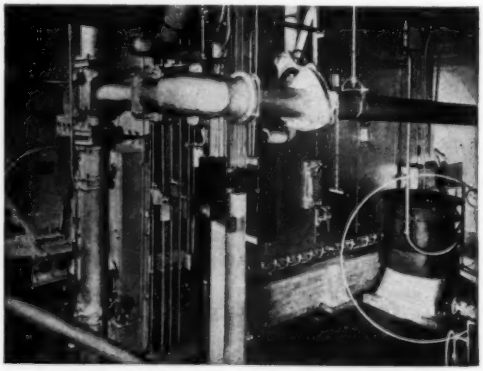
COMPACTNESS, EASE OF REGULATION, LOW MAINTENANCE—IN THE WING FORCED DRAFT BLOWER


FLANGE FOR ATTACHING TO WIND-BOX OR AIR DUCT
AIR STRAIGHTENING VANES
WINGFOIL FAN WHEEL
VOLTROL (Volume Control) VANES
Can be Mounted Vertically or Horizontally
VOLTROL VANE CONTROL MECHANISM
FULLY ENCLOSED DUST-PROOF MOTOR
LEVER FOR CAPACITY REGULATION

Wing Axial Flow Blowers for over half-a-century have been delivering consistently satisfactory performance in thousands of boiler plants. Today's Wing Blowers with many superior features—such as the Voltrol Vanes for capacity regulation down to 10% at maximum—are to be found as standard equipment on many of the country's leading makes of boilers. Photo shows typical installation on an oil burner windbox. No ducts or extra supports required.



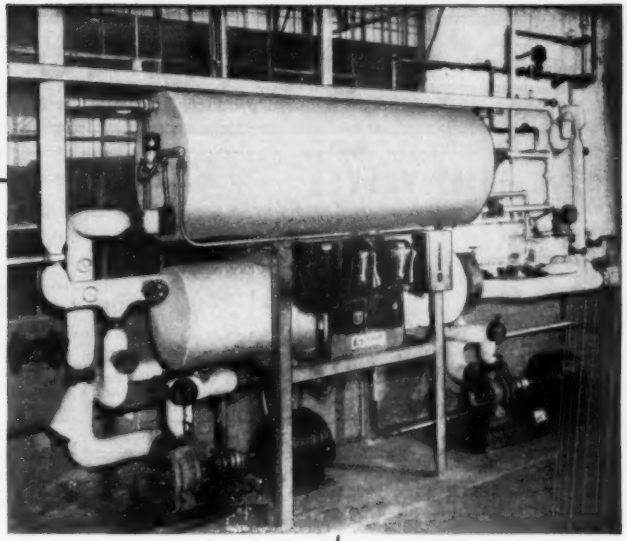
L. J. Wing Mfg. Co. 50 Vreeland Mills Rd. Linden, New Jersey

Offices in Principal Cities of U.S. & Canada

Wing

AXIAL FLOW FORCED DRAFT BLOWERS

SCHAUB
BOILER RETURN SYSTEMS

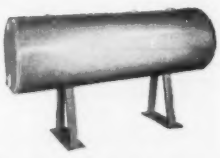


A duplex S5K-D Schaub deaerating type Boiler Return System in modern Chicago industrial plant. Equipment includes Model 2084 feed water heat exchanger, and serves a 200 HP, 200-lb. W. P. boiler.

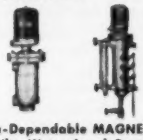
You Get All These Features ...in a SCHAUB

Only Schaub offers you the combined exclusive *money-saving* features illustrated at the right. Any one of these alone would be a sound reason for buying a Schaub System over any other. Take time to compare details. Then you'll quickly see why Schaub gives you *more* for your money on *every* feature. In terms of real savings—you get improved operating economy, lower maintenance costs and longer equipment life. All this means your return system costs you less per year. Know the facts and you'll readily recognize that a Schaub Boiler Return System is your best value.

Schaub Master-Bilt Turbine Pump
Patented fleximatic shaft seals and pre-lubricated ball bearings mean no packing and no greasing—ever! When you install a Schaub Master-Bilt Pump, you can forget about it.



Chromosoid-Lined Receiver
10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected from costly and premature replacements. No more rust-clogged systems!



Ultra-Dependable MAGNETROL Boiler Water Level Control
Combination pump-control and low water safety cut-off. Friction-free Magnetrol, assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.

Get the Facts! The complete story of how much more you get when you specify a Schaub System is quickly presented in Catalog 55. Write for your copy NOW—it's free!

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Since 1905

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate.

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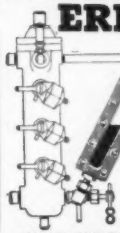

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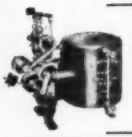

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Return Traps—Lifting Traps
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Consult these SPECIALISTS
Let them save your time by bringing their broad experience in their specialty to bear on your problems.

You've got a Winning Combination

A STANDARD ISA FACE-TO-FACE DIMENSIONS
K "FLOW-LINE" CONTOURED BODY
Q STELLITED SEATING SURFACES
J
10 SEAT RINGS EASILY REPLACED WITH VALVE IN PIPE LINE

with the New TRADE LESLIE MARK

DOUBLE SEATED DIAPHRAGM CONTROL VALVES

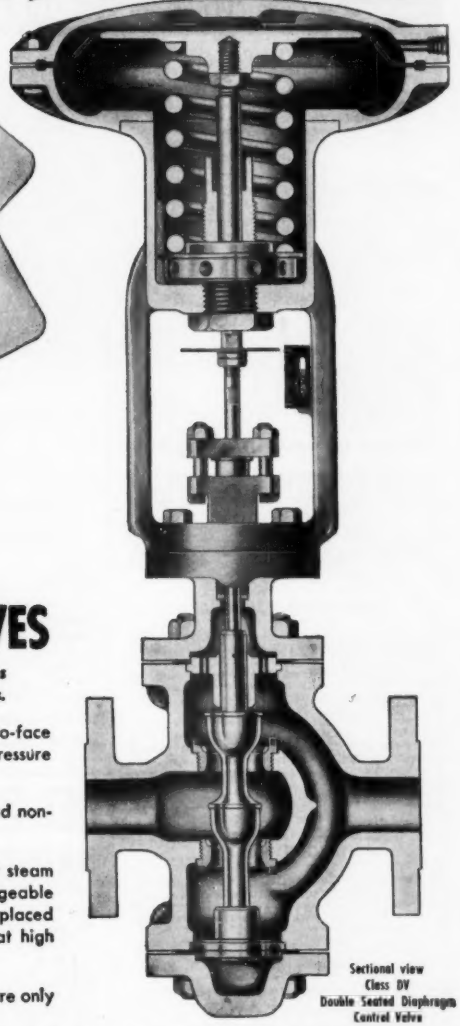
Calling a spade a spade you've got a "royal flush" of features in these new Valves designed for use with control instruments.

Their "Flow-Line" Contoured Bodies have ISA standard face-to-face dimensions and high capacity, low turbulence and minimum body pressure drop characteristics.

A new type, top and bottom guided construction is self-aligning and non-binding regardless of uneveness of bolt tightening.

Standard, integral stellited seating surfaces are recommended for steam service to reduce seat ring thread corrosion. Renewable, interchangeable seat rings also furnished where desired and may be easily replaced without removing valve body from the line. Elaborate grinding at high temperatures is completely eliminated.

With these Valves, you get as *standard equipment*, features heretofore only obtainable in expensive, specially designed valves.



Sectional view
Class DV
Double Seated Diaphragm
Control Valve

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory trained engineers are located:

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WRITE FOR Bulletin 513

ESTABLISHED 1900
LESLIE CO.
©707

235 Grant Avenue, Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
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$1.50 a line. Minimum 3 lines. To figure advance payment count 5 average words as a line. (See ¶ on Box Numbers.)
POSITION WANTED and Individual Selling Opportunity undisplayed rate is one-half of above rate, payable in advance.
PROPOSALS, $1.50 cents a line an insertion.

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BOX NUMBERS count one additional line in undisplayed ads.
DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).
EQUIPMENT WANTED or FOR SALE Advertisements acceptable only in Displayed Style.

DISPLAYED RATE

The advertising rate is $16.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page.
C.A.

NEW ADVERTISEMENTS, N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y., for the April issue closing March 13th.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

DESIGNERS, LAYOUT Men and General Draftsmen on steam turbines and related equipment. We are looking for men who prefer a steady job in a thriving essential industry and who will enjoy living in a pleasant rural community of less than 10,000 population. Excellent schools. Healthful climate and living conditions. Applications confidential. P-3215, Power.

SELLING OPPORTUNITIES OFFERED

WANTED—ELECTRICAL machinery salesman, college graduate with at least five years experience. Duquesne Electric & Mfg. Co., 6428 Hamilton Avenue, Pittsburgh 6, Pennsylvania.

WANTED—REPRESENTATIVES in Industrial Field to handle complete line of blowers, heating and air conditioning equipment. Give full details. RW-3316, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 42 years). Procedure of highest ethical standards individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

CHIEF ENGINEER Available. Cost conscious. Cut Fuel and Labor cost in half on last job. Long and thorough experience in Planning and Building of Boiler Plants. Extensive knowledge of refrigeration, air conditioning, water treating. Maintenance scheduling. Licensed Engineer. Complete resume supplied on request to firms needing outstanding engineer. PW-3325, Power.

DIESEL PLANT Supervisor: Can erect, operate and maintain complete plant. Have factory, field, marine and machine shop training. Some steam experience. PW-3062, Power.

PLANT ENGINEER—Sup't. of Power & Main. 38 yrs. of age, married, 3 children. Several years as Chief Engineer and Sup't. of power and main., industrial and institutional concerns. Just finishing multi-million construction job as mechanical engineer. Good salary and security expected. PW-3362, Power.

WATCH ENGINEER—Ass't Power Suprv. Young married man. State of N. J. Gold Seal stationary license. Sound technical and practical background. Thorough experience modern power dept. Water-treatment, high pressure boilers, condensing and non-condensing turbo-generators. PW-3377, Power.

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Consult: Z. H. Polachek.
Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

WANTED: Experienced Power Station Engineer.
POSITION: Assistant to Manager of Power Production with administrative responsibility of operating central stations totaling approximately 800,000 kw.
LOCATION: Pennsylvania.
ADVANCEMENT: Excellent for growth on job and promotion in near future.
EXPERIENCE: 10 years minimum, with at least 5 years in operation, maintenance or efficiency work in large modern steam-electric central station. Construction and design experience will be considered.
EDUCATION: B.S. degree in Mechanical (preferred) or Electrical Engineering from an accredited engineering college.
AGE: 30-45.
Salary commensurate with qualifications.
All applications will be acknowledged.
Please send personal record to
P-2126, POWER
330 W. 42 St., New York 36, N. Y.

MANUFACTURER'S REPRESENTATIVES

Leading manufacturer of Industrial Dust Collection and Dust Recovery Equipment requires representation in the Boston, Portland, Maine, New Haven and Pittsburgh areas.

Please provide full details in first letter: experience, financial status, present products now handled. Address reply

RW-3493, POWER
330 W. 42nd St., New York 36, N. Y.

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CORPS OF ENGINEERS, Office of the District Engineer, Detroit District, 1900 Cadillac Tower, Detroit 26, Mich., 11 February 1952. Sealed proposals will be received at this office until 2 o'clock p.m. on the 14th day of March 1952, and then publicly opened for the sale of 5 units of used hydroelectric generating equipment, complete, including turbines, generators, miscellaneous switchgear, etc., presently located at Sault Ste. Marie, Michigan. Copies of sale advertisement No. CIVENG-20-064-52-36 (Sales) may be obtained by application to this office and units may be inspected by application to Area Engineer, Soo Area, Corps of Engineers, Sault Ste. Marie, Michigan.

FOR SALE
2 STEAM ENGINE GENERATING UNITS

1—Skinner uniflow horizontal direct connected 150 KW Elliott generator; 480 volt, 3 phase, 60 cycle, 200 rpm., 130-145 PSI steam, 3 PSI exhaust.
1—Elliott 4-valve horizontal direct connected 250 KW Elliott generator; 480 volt, 3 phase, 60 cycle 180 rpm., 130-145 PSI steam, 3 PSI exhaust.

Both units with panels and accessories. Can be seen operating; condition good; available.

See or write:
WM. H. EMIG, *Chief Engineer*
ST. LUKE'S HOSPITAL, 5535 Delmar Blvd.
ST. LOUIS 12, MO.

FOR SALE
Induced Draft Fan

Capacity 38,000 CFM of air with 1¼" draft at fan. This is a Buffalo-Forge Company #28, type LL induced fan, arrangement #1, class 2 construction, 687 RPMs. Fan rotor is of the overhung type with water cooled bearings. Fan is driven by a 20 HP, General Electric, 220 volt, 3 phase, 60 cycle, 1800 RPM squirrel cage induction motor. Complete with CR-1034 hand compensator starter. Motor driven by means of Allis Chalmers V belt drive.

MAJESTIC LAUNDRY CO.
63 Lock St., New Haven, Conn.

BOILERS—New and Used

1—1000 H.P. New B.&W. 475#
1— 200 H.P. New Com. Eng. 150#
4— 250 H.P. Used Self-Contained Kewanee 125#
1— 145 H.P. Com. Eng. 150#
3— 150 H.P. Used H.R.T. 150#
2— 200 H.P. Water Tube
3— 300 H.P. Water Tube
Above complete fittings & stokers. For other sizes let us know what you need.

R. A. HACKNEY
7171 Washington Blvd., Indianapolis, Ind.

FOR SALE

125 HP Murray Iron Work boiler and 50 ft. stack good condition will sell cheap.

FARMER'S CO-OP ELEVATOR CO.
HUBBARD, IOWA

STEAM TURBINES

NEW AND UNUSED—Can be adapted to provide your own electric power. Can produce enough power to light up a small city.
Manufactured by Bethlehem Shipbuilding Corp.
MANUFACTURER'S COST $225,000 Per Pair
Our Price $25,000 Pair L.P. & H.P.
Rated Power English Units open 2140 S.H.P. Closed 5450.

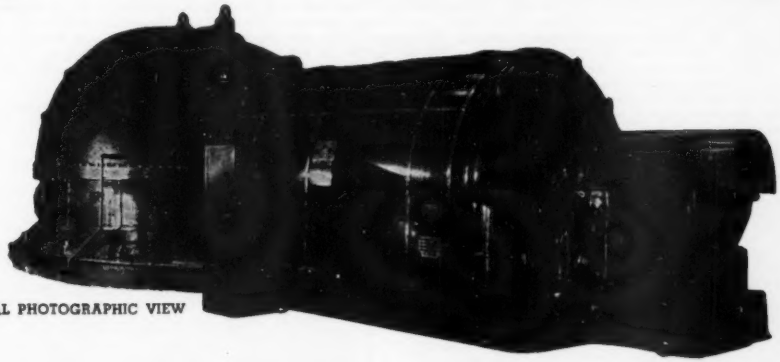
GROSSMAN'S
130 Granite St., Quincy, Mass. PResident 3-7100

FOR SALE
Two 125 HP General Electric Motors

550 volt, sixty cycle, three phase, 1165 speed full load, type F T H, model 84-E-196-G-1, number 5455381, and 5455380. Write

FB-3448, POWER
330 W. 42 St., New York 36, N. Y.

25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° T.T. complete with direct connected shaft exciter, switchboard, a 30,000 square foot Westinghouse surface condenser and condensing accessories, including 2—150,000 pounds steam per hour B&W sectional header cross drum boilers, 250# pres., 550° T.T. equipped with Taylor retort stokers.



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EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# P.S.I., 600° TT.
4000 KVA Allis, 2300 volts, 150-200 PSI.
3750 KVA Westghse. 2300 volt, 200 PSI.
2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing alternating current generator LESS TURBINE.
2500 KVA Westghse. 2300 volt, 250 PSI.
1563 KVA Allis, 600 volts, 200 PSI.
1250 KVA G.E. AUTOMATIC EXTRACTION BLEEDER 2300 volts, 250 PSI.
937 KVA Allis, 480 volts, 250 PSI.
780 KVA Allis, 480 volts, 150 PSI.
625 KVA G.E. 480 volts, 150 PSI.

Non-condensing—3 phase, 60 cycle

1563 KVA G.E. 600 volt, 250 PSI, 20# gauge back.
940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.
625 KVA G.E. 480 volts, 125-150 PSI, 20# back.
375 KVA Westghse-Moore 480 volts, 250 PSI 5-10# back.
250 KVA Allis 480 volts 125 P.S.I.
125 KVA G.E., 2300 volts, 150-200 PSI.
125 KVA Westghse. 2400 volts, 150-250 PSI 10# back.

Direct Current

500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.
300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.
100 KW (2) G.E., 125 volts, 200-275 PSI.
75 KW (2) Westinghouse-Moore. 120 volt, 200# P.S.I. condensing.
60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing.

MOTOR GENERATOR SETS

100 KVA Westghse. 60 cycle, 2400 volts, alternator connected 135 HP, 250 volt direct current motor.
62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.
50 KW G.E. 125 volt direct current 1200 RPM to a 3 phase, 60 cycle, 220 volt syn. motor.
10 KW G.E., 125 volt direct current to a 3 phase, 60 cycle, 220 volt motor.

March BARGAINS SPECIALLY PRICED

800 KW, 60 cycle, 2300 volt, 600 RPM Westghse. alternator.
2—225 HP, 400 RPM Buckeye Diesel engines each connected 1875 KVA, 60 cycle 240 volt Electric Machinery generators.
547 HP, 250# pres. and three 400 HP, 225# pres. B&W water tube boilers.
8000 sq. ft. Wheeler, 4400 sq ft. Worthington, 2000 sq. ft. Worthington and one 1500 sq. ft. Westinghouse surface condensers.
4900 GPM and 3500 GPM Allis 2-stage pumps, 130 ft. hd. each direct connected 400-325 HP Allis 3 phase, 60 cycle, 2300 volt motor.
2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I., G.E. turbine.
25 HP G.E. 60 cycle, 220 volt, 1170 RPM totally enclosed fan-cooled motor.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Syn. (condenser).
900 HP Allis, 2200 volts, 150 RPM.

UNAFLOW GENERATOR UNITS

625 KVA G.E. 240 volt generator connected 29"x36" Skinner horizontal engine, 150 PSI complete.
500 KVA G.E. 240 volt generator connected Skinner Vertical engine 150-175 PSI complete.
375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal engine, 125-150 PSI.
175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

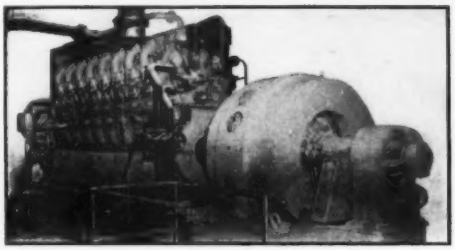
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.
250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.
20 KW Allis 125 volt generator connected Hill vertical Diesel engine.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

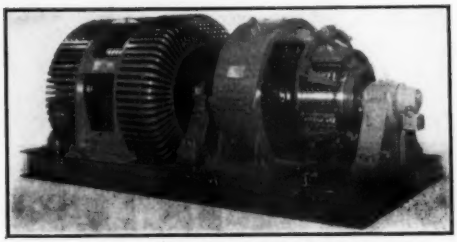
"THE O'BRIEN STORY"

KNOWLEDGE . . . FACILITIES . . . CAPITAL . . . EXPERIENCE . . . these are the requisites around which The O'Brien Story is built. With over 37 years of experience and know how in Manufacturing, Rebuilding, Reconditioning and Distributing Industrial Machinery of all types The O'Brien Machinery Company has expanded until today we are, in addition to being Philadelphia's leading Machinery dealers and exporters, one of the nation's outstanding Machinery houses. Our facilities consist of over 100,000 sq. ft. of fully equipped shops and warehousing space manned by our complete staff of graduate mechanical and electrical engineers, competent buying and selling personnel, trained electricians and skilled machinists. Our representation is both national and international, and our service facilities are linked from coast to coast. The name O'Brien in the machinery industry stands for quality and integrity which is the keynote of our success. "Know the integrity of your dealer and you will know the quality of your machinery."

Read More About "The O'Brien Story," In the next Issue of Power.



1250 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1500 KW GE MPC 300 V 5000 Amp.—2150 HP ATI-Syn Motor, 3/60/4000 Volt. Available immediately.
1—1000 K.W. West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels.
1—660 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 ph., 60 cy., 2300 V. A.C. & D.C. Panels. Can furnish 3 ph. 550 V. or 2300 V.
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 5/6/2300 V. A.C. & D.C. Panels.
1—400 KW West. 500 Volt D.C. Any A.C. Voltage with 500 HP West. 350 RPM, 500 Volt Motor for complete drive.
1—360 KW GE CY 125, 180 V., Sep. Exc., 1200 RPM, 500 HP Syn. Mtr., 3/60/2300, 1942.
1—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM —Automatic Controller & D.C. Panel.
2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.
1—100 K.W. Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 K.W. Burke 250 V., 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

CENTRIFUGAL PUMP

Qu.	GPM	TNH	Descr.	Size	HP	Speed
2	10,000	200′	LeCourtenay	20″	624	870
2	10,000	100′	LeCourtenay	20″	350	870
2	8,150	132′	LeCourtenay	16″	350	1150
1	8,000	110′	Worthington	14″	200	1200
2	7,000	200′	LeCourtenay	16″	423	1000

CENTRIFUGAL PUMP (Con't)

1	6,000	110′	Ingersoll-Rand	12″	500	1200
1	4,000	110′	Ingersoll-Rand	12″	500	1200
1	3,500	47′	Southwalk	12″	75	870
2	1,700	95′	De Laval	10″	60	1750
1	1,500	231′	Allis-Chalmers	8″	150	1750
1	1,200	40′	Worthington	6″	15	1750

DIESEL & GASOLINE GENERATOR SETS

2—1250 K.V.A. GM 16 Cyl. 3/60/2300 New 1946 Comp. Plant. (See Photo Above)
1—937 K.V.A. GM 12 Cyl. New Engine. Rebuilt Gen. 3/60/480 or 2300.
1—625 K.V.A. Baldwin Series 600—New 1948 —1500 hours. 3/60/2300/514 RPM.
2—438 K.V.A. GM—West. 3/60/2200 360 RPM —New 1937. Complete Plant.
2—375 K.V.A. GM 8-268A, 3/60/480/1200 RPM.
1—300 K.W. GM New 8-268A, 230 DC.
1—250 K.V.A. GM Twin 6-71, 3/60/220/440.
1—125 K.V.A. GM New Twin 4-71, 3/60/220.
1—125 K.V.A. Hercules. 3/60/220/440/1500 Hrs
1—62.5 K.V.A. Cummins 6 Cyl. 3/60/220/440.
1—56 K.V.A. Climax Gasoline. 3/60/220/1200.
2—45 K.V.A. Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
3	500	West.	CS	6600	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (3 brg.)	550	600
1	125	Cent.	SC	440	1800
2	100	G.E.	Syn.	440	300
1	75	West.	CW	440	1200
1	50	West.	CS	440	3600

TURBO GENERATORS

1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
2—375 KVA West. Non-Cond. 3/60/440 125 psi 5 B.P. New 1938

TURBO GENERATORS (Con't)

1—300 KW West. 3 wire 125/250 Volt D.C., Non-Cond. Turbo Unit 125 PSI, 5 lbs. B.P. New 1938
1—75 KW G.E. Non-Cond. D.C. 125 volt.
1—35 KW G.E. Non-Cond. D.C. 125 volt.

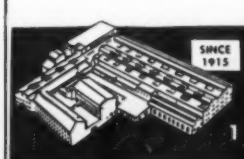
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 I.b., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 864 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 3 Angle Cpd. 100 psi 22/13x16 belt.
2—1200 CFM I.R. 22/13x16 100 psi belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—754 CFM Sullivan W-13 13/13x8 60 lb. belt.
1—528 CFM CP NSB 14x12 100 lb.
1—371 CFM Schramm 7¼/5x4 100 lb.
2—368 CFM I.R. ER-1 12x10 100 psi.
1—350 CFM I.R. type 40 7/6¼x5 air cooled 125 lb. direct 75 HP 220/440/60/3 870.
1—327 CFM Sullivan type WL-60 100 psi.
1—233 CFM Penna. 3A 10x8 70 lb.
1—173 CFM CP NSB 9x8 100 lb.
1—173 CFM Penna. 3A 9x8 100 lb.
1—122 CFM Worthington 7x7 Horiz. 100 lb.
2—89 CFM CP 6x7 TB 150 lb.
1—40 CFM I.R. Type 30 80 lb. Tank mtd. 7½ HP
3—21 CFM Curtis CJ-1000, 3 stage 850 lb.
5—16.86 I.R. Type 30, 3¾/2x5 400 lb.
100—10 CFM I.R. Type N 26 lb. or 25" Hg. Vac.

BOILERS (ASME)

2—106 H.P., Keeler, Self-contained, 125#
1—240 H.P., Keeler, Horizontal, Long-Drum, Water Tube, 200#
2—250 H.P., Bigelow, Self-contained, 125#
2—360 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr., Water wall 250#
1—890 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr. Water wall, 300#

"Everything from a Pulley to a Powerhouse"



SINCE 1915

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RE-NU-BILT BELYEA MOTORS

THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED 44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500	600	6600/11000
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1500	G.E.	600	600	2300/4150
2	1000	Whse.	900	600	2300/4150
1	1000	G.E.	720	600	2300/4600
1	1000	G.E.	900	260	4850
1	1000 (3U)	G.E.	900	250	2400/4800
2	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G.E.	900	125	2300/4150
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140 (3U)	Cr. Wh.	600	125/250	2300
1	125	G.E.	1200	125	440
1	100	G.E.	1170	125	220
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
1	70	G.E.	1200	70	220/440

*25 Cycle

ROTARY CONVERTERS

60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60-Exc. & Surface Cond.
1	2500	G.E.	Auto. Ext. Cond. 800 lbs.-800° F.T.T. 175/200 Auto. Ext. 2300/3/60 Exciter & Surface Cond.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/30 lbs. G.B.P., 480/3/60.
1	750	G.E.	Condensing 425#-725°TT ISP-440 V. 3 ph. 60 cy New—1944
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
1	400	Whse.	Non-condensing 125/150# ISP 5/10# G.B.P. 240/480v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D.C.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.

400 KW MADE UP MG SET
CAN MAKE UP SIMILAR SET

D. C. MOTORS

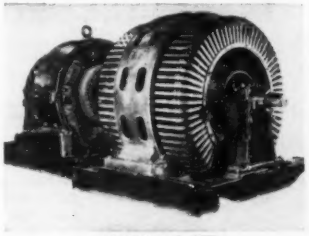
Qu.	HP	Make	Type	Volts	Speed
1—	2200	G.E.	MCF	600	360/500
1—	1750	West.		600	525/750
1—	1500	Whse.		525	600
1—	940	Whse.	QM-R. Brg.	250	140/170
1—	800/1000	Whse.		450	600/720
1—	600	Al. Ch.	MILL	230	400/800
1—	500	Whse.	Mill	600	300/900
2—	450	Whse.		550	415
1—	300/400	G.E.	DYNA	250	1325/2500
1—	250	Cr. Wh.	CCM-151H	230	1100
1—	235	Whse.	MQ	250	300/900
1—	200/300	G.E.	MFC	230	250/920
1—	250	G.E.	MFC	230	400/500
1—	150	G.E.		600	250/750
10—	150	Cr. Wh.	83H	230	800
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	300/950
1—	50/120	G.E.	MFC	230	350/1000
2—	100	Whse.	SK-181	230	450/1000
4—	75	G.E.	TLC-50	250	850/2500

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—	3000	G.E.	25/60	4000/2300x2300/4000
1—	1000	G.E.	25/58	4400/2300
1—	500	A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed
1	5000	Whse.	3400/4800	600



500 KW MG SET
IN STOCK

TRANSFORMERS

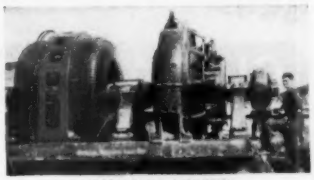
60 Cycles

Qu.	KVA	Make	Type	Ph.	Voltages
1	1250	Whse.	OISC	3	13200x595/460
3	1000	G.E.	H	1	2300x480
3	1000	Pitts.	OISC	1	22800x13200/2200
3	1250	G.E.	H	1	6600x550
3	1065	G.E.	OISC	3	22860/13200x2300
3	500	Al. Ch.	OISC	1	11800x6600
1	500	Whse.	OISC	1	34650x433
1	500	Whse.	OISC	3	13400x216
3	500	Al. Ch.	OISC	1	13200x2300/575
3	333	Whse.	OISC	1	44000/22000x2300
3	200	Whse.	OISC	1	44000/22000x2300
9	300	G.E.	HT	3	2400x240/480
3	150	Whse.	OISC	1	34500x230/460
3	100	G.E.	OISC	1	2400x120/240

RECTIFIERS

Qu.	KW	Make	Type	Volts	Speed
1—	750	G.E.	BHW	575	2300
1—	1000	A.C.	B-612	625	13500
1—	1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.



2000 KW—MG SET
IN STOCK

A. C. MOTORS

3 ph. 60 Cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
5—2100	G.E.	ATI	2300	360
3—2000	Whse.		2300	120
3—1750	G.E.	ATI	2300	3600
3— 900	Al. Ch.	(New)	2300	150
3— 735	G.E.	ATI	2200/12000	600
1— 650	Whse.	G	2200	138
1— 500	G.E.	TS 7857	2400/4800	600
1— 450	Whse.	Eng.	2200	128.5
1— 450	Whse.		2300	450
3— 350	G.E.	TS	2300	180
1— 300	Whse.		2300	720
1— 100	Whse.		550	600
1— 100	F.M.		220	1200
1— 100	R.M.		440	600
1— 85	G.E.	TS	440	1800

SLIP RING

1— 800	Whse.	CW	550	250
2— 500	G.E. unused	M-574Y	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
1— 500	G.E.	IM	440	900
1— 350	G.E.	MT442-Y	2300/4000	253
1— 300	Al. Ch.	3 Brg.	2300	506
1— 300	Al. Ch.		2200	385
4— 300	G.E.	ITC-5017	550	585
1— 300	Al. Chal.	ANY	2200	700
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559B	2200	1750
1— 200	G.E.	MTP	440	1170
3— 200	G.E.	IM-17	440	580
1— 150 new Whse.		CW	2300	450
4— 125	G.E.	MT-560Y	440/2300	435
1— 100	G.E.	IM-16	2200	435
3— 100	G.E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G.E.	MT556	2200	900
1— 75	Whse.	CW-761	2200	1725

SQUIRREL CAGE

2— 650	G.E.	FT559BY	440	3750
2— 450	Whse.	CS	2200/4150	354
1— 300	G.E.	KT-574Y	2300	505
1— 200	G.E.	IK-17	440	580
1— 200	G.E.	KT557	440	1800
1— 200	G.E.	IK	440	885
1— 150	Westghse.	CS856S	440	880
1— 125	Whse.	MS	440	485
1— 125	G.E.	KF-TEFC	440	3585
2— 125	Al. Ch.	ARW	2200	1750
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-513	220/440	1750

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YOU CAN DEPEND ON A-1 PERFORMANCE

GENERAL REBUILDING

Precision equipment in the hands of Chicago Electric "Craftsmen" is the basis for general rebuilding operations on your job. Your motor or other equipment is stripped and given a thorough check and then rebuilt to perform as per original specifications and meet the terms of our guarantee.

GUARANTEED REBUILT POWER EQUIPMENT

HERE'S A PARTIAL LISTING OF OUR HALF-MILLION DOLLAR STOCK

SQUIRREL CAGE
MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
1000	*G.E. (New)	K63478	1800
750	*G.E.	KT	720
500	*G.E.	PPG	1800
500	*Fr-Morse	H8	1200
450	*G.E.	KP-5678	1200
400	*Cent. (New)	NS	1200
400	*G.E.	IK	514
370	*Cr-Wh.	SC	3600
300	*Westgh.	CS	3600
300	West.	C8	514
300	G.E.	IE-K	1200
300	Al.Ch.	AR	900
250	*L.-Allis	6GX-1488	720
250	Al.Ch.	630DSWW	1200
250	G.E.	IK	600
200	*G.E.	IK-13B	1800
200	G.E.	IK-17	600
150	G.E.	KT-346	1800
150	G.E.	IEK	1800
150	*Al.Ch.	AN	1800
150	*G.E.	IK	600
150	G.E.	IK (550v)	514
150	G.E.	IK	450
125	*A.C.	AR-226	1800
100	*G.E.	FT342Z	1800
100	G.E.	FTRP	1800
100	*Westgh.	C8	1800
100	U.S. (Vert.)	CFU	1200
100	Al.Ch. (new)	AW	1200
100	Reliance (new)	AAC (TEFC)	1200
100	G.E.	IK15A	1200
100	*West.	C8	1200
75	West.	C8645C	1800
75	G.E.	KT-346	1200
75	Triumph	TR16	514
75	G.E.	IK	600
75	G.E.	IK	514
75	Al.Ch.	AN	1800
60	*Westgh.	CS581	1800
60	A.C. (New)	APZ4458	1800
50	G.E.	KT327	1800
50	U.S. (Vert.)	SCV937	1800

Hundreds of Smaller Motors

HI-PRESSURE PUMPS

GPM	Make	Type	Head
800	Worth.	6D8	925 Ft.
800	Manistee	H	250 Ft.
500	Al.-Ch.	NM2	800 Ft.

ELECTRIC SHOVEL OR CRANE DRIVE

250 V. - VARIABLE VOLTAGE

1—100 KW DC Hoist Generator
1— 25 KW DS Swing Generator
1— 24 KW DC Crown Generator
Driven by
190 HP Syn. Motor, 3/60/2300 v.

MOTORS

1— 75 HP G.E. MDS106 Hoist
1— 30 HP G.E. MD104½ Swing
1— 30 HP G.E. MD104½ Crowd

SLIP RING
MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Cr.-Wh.		240
650	Westgh.	HE	350
500	Westgh.	CW	257
400	A.C.	3 Brg.	450
400	*G.E.	MT-412	450
300	*G.E.	IM-15	1800
300	*G.E.	MT-410	450
250	Westgh.	HP15H	600
200	Westgh.	CW	600
200	G.E.	IM	1000
150	Westgh.	CW772C	1200
150	*G.E.	IM-16	600
125	*G.E.	MT-240	1800
125	G.E.	IM17A	600
125	G.E. (New)	M6333Z	900
100	A.C.	ANY	900
100	G.E.	IM	450
75	G.E.	MT347	1300
75	G.E.	MT356	900
75	G.E.	IM	720
75	Star	OSOO	900
75	G.E.	IM-14	600
60	Westgh.	CW762C	900
50	G.E.	IM11A	1800
50	A.C.	AHY	1800
50	Westgh.	CW626A	1200
50	G.E.	MT346	720
50	G.E.	IM	600
50	G.E.	IM11	425
40	G.E.	MT236	1200
40	Westgh.	CW642C	1200

CHANDEYSSON ANODIZER

NEW 1000 Amp. 40 volt, type NPT, d/c to 60 HP A-28 Syn. Motor, 3/60/220, 600 RPM, 25°C. continuous.

D. C. MOTORS

230 Volts — Constant Speed

H.P.	Make	Type	Speed
375	Westgh.	Ped	650
200	Westgh.	SK210	800
175	G.E.	ELC11	750
125	G.E.	Marine	1200
100	G.E.	BC24	2500
100	Westgh.	SK173	850
100	A.C.	E152	575
40	Cr.-Wh.	CMC	1750
40	G.E.	CO2001	600
35	Cr.-Wh.	CM251	700
35	G.E.	C	600
30	Westgh.	SK120	975
30	Cr.-Wh.	CCM	450
30	Westgh.	SK923	1750
30	G.E.	RC51B	1150
25	Westgh.	SK113	850
25	Westgh.	SK100L	1100

MANY OTHERS—1 HP and Up!
ALSO 115 VOLT

AC SYNCHRONOUS
MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	P.F.	Spd.
1420	*Westgh.	Syn.	.7	900
800	G.E.	TS934	1.0	1200
700	G.E.	TS		514
320	*Al.-Ch.	Dr. Pf.	1.0	720
300	Cr.-Wh.	Eng.	1.0	300
300	*G.E.	ATI	1.0	720
300	G.E.	ATI	.8	900
275	Ideal		.8	257
250	*Al.-Ch.	Dr. Pf.	1.0	720
220	G.E.	ATI	1.0	600
150	*Westgh.	HB	1.0	300
125	Parkinson			900
125	El. Mach.	Syn.	1.0	900
125	Cr.-Wh.	103-8	1.0	900
125	*G.E.	TS	1.0	277
115	E.-M.	EM	1.0	240
100	Cr.-Wh.	103-8	.8	900
100	*G.E.	ATB	.8	900
100	Ideal	8MS	1.0	900
75	G.E.	ATI	1.0	900
40	G.E.	ATB	.8	1200
20	Fynn W.	15VBN		1200
15	Century	ABC365	1.0	1200
4	G.E.	AK (25 cy.)		1500

D. C. MOTORS

ADJUSTABLE SPEED

230 Volts (*115 Volt)

H.P.	Make	Type	Speed
35	G.E.	BF-13	500/1000
30	G.E.	C	300/900
20	A.C.	ER-145	300/1200
15	*Triumph	Planer	225/900
12.5/15	G.E.	BC-116	500/1500
10/15	Reliance	1871	400/1600
10	*Elec-D	2Sp8	400/1200
10	G.E.	BF-11A	400/1200
10	G.E.	RD-10A	600/1800
10	West.	SK-100	400/1600
10	G.E.	CR-10	450/1350

AC SYNCHRONOUS
GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

K.V.A.	Make	Type	P.F.	Spd.
1500	G.E.	ATI	.8	900
250	*Al. Ch. (new)		.8	720
150	El. Mach.	EM	.8	720
112.5	*G.E.	ATB	.8	1200
110	Cr. Wh.	103	.8	900
100	*G.E.	ATB	.8	900
60	Fr.-Morse	B	.8	900
35	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200

1000 KW M.G. SET
3-UNIT

2—500 KW West. DC Gens., 275/137.5 V, 3 wire, 1820 Amps.

D/C TO

1420 HP West. Syn. Motor, 900 RPM 11,000 V. 60 Cy., 3 ph. 3 Brg. on Castiron Factory Base.

M. G. SETS

K.W.	Make	A.C.	D.C.
500	Al. Ch.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3 unit)	2300	125/250
250	West.-G.E.	440	250
200	Ridgeway	2200	250
150	G.E.	2300/440	250
150	G.E.	440	250/375
100	G.E.	440	250
100	G.E.	220	250
100	G.E. Delco	440	120/240
75	Al. Ch.	440	250
60	Al.-Ch.	2300	110
40	Cr.-Wh.	220	125
40	El-P-GE	440	250
40	Al.-Ch.	440	250
20	G.E.	440	250
15	G.E.	220	250
10	G.E.	440	125
10	G.E.	440	250

D.C. TO A.C.

75	Westgh.	110	2300

ROTARY CONVERTERS

1000	G.E.	600 v	DC
500	G.E.	600 v	DC

ENGINE-GENERATOR SETS

KVA	Make	Type	Volts	RPM
300	G.M.	8-268A	480	1200
100	G.M.	6-71BC	480	1200
31	Cum.-Reg.	H-1-6	120/208	1200
25	LeRoi	20-A	120	900
10	Onan	MDGG	115/230	1800
1½ KW	Kohler	D-7551	110 DC	1000
1	Onan	10L-103	115	

TRANSFORMERS

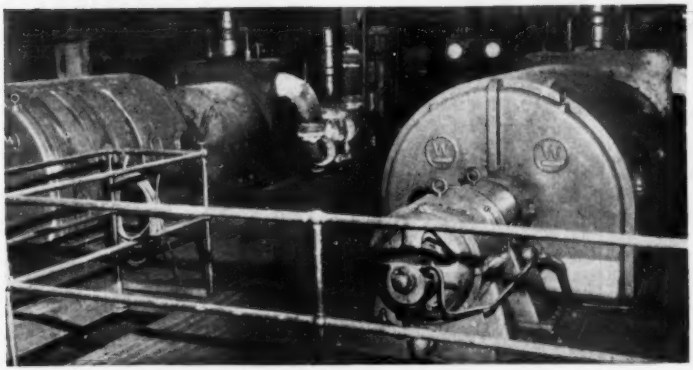
KVA	Make	Ph.	Prim.	Sec.
2000	Pittsb.	1	12000	2300
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
500	G.E.	3	13200	445
300	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
167	Al.Ch.	1	2400	120/240
100	Al.Ch.	1	2400	120/240
75	Al.Ch.	1	2400	120/240
SMALLER RATINGS			2400 to	120/240

First Source for 42 Years of Quality Electrical Equipment

CHICAGO Electric Co.

1320 W. CERMAK RD. • CHICAGO 8, ILLINOIS

2500 KVA — WESTINGHOUSE TURBINE-GENERATOR
Non-condensing
A MODERN HIGH GRADE UNIT



Above is our 2500-KVA., Westinghouse Non-condensing Turbo-Generator. It is one of the most modern, best conditioned units we have ever owned. Originally, we had two (duplicates): one has been sold to one of the largest Paper Mill Co.'s, and is giving complete operating satisfaction. Unit is good for 450# psig. and 50# B.P., with moderate changes. Voltage 3/60/2400. Is now in dry storage. Had limited service, always proper maintenance. Inspection Reports, Drawings, Complete Specs. on request.

IMMEDIATE DELIVERY. INVESTIGATE.

Water Rates—KW. Load: 1000, 1500, 2000, 2500. LBS. KWHR: 27.1, 25.85, 26.0, 26.2

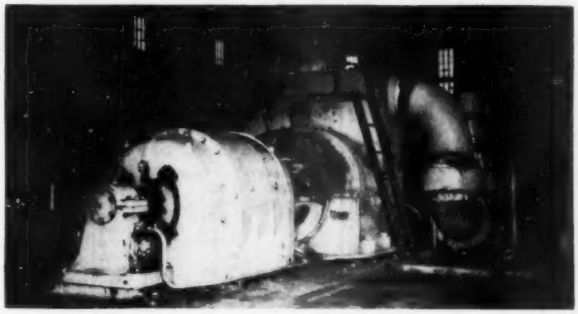
A RARE OPPORTUNITY TO SECURE SAME AS NEW UNIT AND SAVE THOUSANDS.

625-KVA., WESTINGHOUSE 450# psig, 125# Back, Turbo-Generator, *with Changes*
Non-condensing: Like New. Perfect Condition.

The 625-KVA., Westinghouse Turbo-Generator, at the right, our own Property, is stored and ready for Immediate Installation. With moderate Changes it is good for 450# psig, 125# back and Voltage is 3/60/2400.

Always used as a Standby unit: Very Limited Service, is like a New Machine.

INSPECTION INVITED.



ADVISE IMMEDIATE INSPECTION IF INTERESTED. ARE YOU?

CONDENSING TURBINE SETS: WE OWN 20 COMPLETE UNITS OUTRIGHT. ALSO HAVE COMPLETE LINES OF BOILERS AND DIESEL ENGINES.

TELEPHONE
WRITE
TELEGRAPH

CHARLES WEAVER
Electrical-Mechanical Engineers
41st Floor Penobscot Building, Detroit 26, Michigan

TELEPHONES:
Woodward 1-1340
" 1-1341
" 1-6038

DRAWINGS, COMPLETE DATA, PHOTOS ON ALL UNITS CHEERFULLY FURNISHED
WHAT DO YOU NEED? • SEND US YOUR SPECIFICATIONS

BUY or RENT From L. J. LAND for

- Dependable Equipment
- Reliable Rebuilding
- 1 YEAR GUARANTEE
- REAL VALUES

1 to 50 HP
NEW and REBUILT
TEFC—EX. PR.—Drip proof and Splash proof—Geared Head
IN STOCK

SQUIRREL CAGE MOTORS
3 phase

H.P.	Make	Type	Speed
250	G.E.	KT 559	1750
200	Wagner	RP226F	1800
200	Al.Ch. (2)	BB	880
200	G.E.	KF-6335	880
150	West.	CS	1150
150	West.	CS	580
125	Al. Ch. (5)	AR	1750
100	West.	TEFC	3600
100	Al. Ch.	AR	1150
100	West.	CS	870
100	G.E.	IE-K	1800
100	G.E.	K-544	1175
75	West. (2)	CS-654C	1750
75	G.E. (2)	KT347	1150
75	G.E.	IK	900
75	G.E.	KT-352	865
75	West.	CS	720
60	Howell	SCR	1800
60	West. (2)	CS-607	880
60	Rel.	AA	875
60	G.E.	KT-346	865
60	G.E.	TEFC(GH)	427
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	G.E. (2)	KT	1740
50	G.E.	XP	1750
50	G.E.	KF-445	1170
50	West (3)	CS	870
50	G.E. (2)	IK	870

SLIPRING MOTORS
3 Phase

H.P.	Make	Type	Speed
600	Cr. Wh.	131AQ	507
500	G.E. (2)	IM	450
500	Ideal		1150
400	West.	CW	450
400	G.E.	IM	870
250	G.E.	IM	435
225	Wagner	25 cy.	719
200	G.E.	MT559Y	1170
150	Wagner	31VRN	900
150	Burke		720
125	West.	CW	1750
125	Burke		600
100	G.E.	MT347	1150
100	G.E.	IM	690
75	Lincoln	IXM	1750
75	West.	CW	1150
75	West.	CW	720
75	G.E.	IM	690
60	G.E.	MT533	1750
60	West.	CW116	290
50	G.E.	MT-536	1150
50	Wagner		1150
50	L.A.	OGH	870
50	Cr. Wh.		900
50	G.E.	MT546	720
50	G.E.	IM	490

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
300	G.E.	ATI	900
200	West. (3)		900
180	G.E.	ATI	900
150	G.E.	TS	900
150	G.E.	TS	720
150	G.E.	ATI	900
100	G.E.	ATI	1200
75	G.E.	TS	900
55	El.Machry.	BRKT	1200

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
150	G.E.	L.C.	1750
100	Al.Ch.		1150
90/45	G.E.	RF-17	950/475
75	Cr.-Wh.	53H	850
75	G.E.	RC36	800
75	West.	SK-180	475
75	Cr. Wh.	CMC	375/950
60	West.	SK-160	650
60	West.	SK	250/1000
50	G.E.	CD	3600
50	West.	SK-160	565
50	G.E.	RF-17	250/1000
45/90	G.E.	RF-17	475/1950
40	West.	SK-103	1750
40	G.E.	RC-31	1700
40	G.E.	CD-1441	400/1600
40	Rel.	461T	400/1200
35	West.	SK	250/1000
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West.	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200
25	West.	SK113	850

115 V.D.C. MOTORS

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr.Wh.	CCM	900
40	G.E.	DLC	1150
40	G.E.	RC	1040
40	G.E.	CD-113	850
30	Eck.		950
25	G.E. (3)	CD	1800
25	G.E.	CD93	1150
25	Cr.Wh.	CCM	750
25	West.	SA	600/1200
20	G.E.	CD85	1150
15	E.D.	7½S	650/1250
15	Cr.Wh.	CM	650
15	Cr.Wh.		1800
15	G.E.	RC	1200
10	Al.Ch.		900
10	E.D.	7½S	425/1700

550 V.D.C. MOTORS

HP	Make	Type	Speed
765	G.E. (3)	MPC	1045/1350

AC GENERATORS

KW	Make		Speed
180	G.E.	ATB	900
100	G.E.	ATB	360
45	G.E.	ASI	1200
15	G.E.	ASI	1200

AC GENERATORS
Driven by DC Motors

KVA	Make	D.C. Input	A.C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	Ely. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El. Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G.E. (4)	1200
325	G.E.	1200
30	Burke	1750
20	Reliance	1150

GENERATORS
250 V.D.C. Motor Driven

KW	Make	Speed
1000	G.E.	514
500	G.E.	900
400	Cr.-Wh.	1200
300	Elliott	1200
250	Cr.-Wh.	1200
250	G.E.	1150
200	G.E.	1200
200	Al. Ch.	900
150	West.	900
125 (2)	G.E.	1200
100	West.	1200
100	Delco	1200
100	G.E.	700
75 (2)	Cr.-Wh.	1200
75	G.E.	1200
40	Rel.	1750
42	ABC (2)	1200
30	G.E.	1200
25	G.E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
150	West. (2)	1200
100	West. (2)	900
100	G.E.	1200
100	El. Machry.	1200
100	West.	1200
75	G.E.	1150
50	West. (2)	1150
30	G.E.	1150
30	L.A.	1450
25	El. Machry.	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
10,000	HVW	6/12
10,000	North.	2½/10
4,000	HVW	6/12
5,000	HVW	6/12
2,500	Chandeysson	6/12
125	Hobart	7½
500	Chandeysson	12
1,000	West. SK	24
1,500	Century	24
2,000	G.E.	24V
100	Hertner	28
150	G.E.	30
200	West.	30
500	West.	32
1,000	G.E.	33
150	Watton	40
1,000	Chandeysson	40
200	G.E.	42
325	West.	50
1,500	G.E.	50
1,500	Century	60
1,500	G.E.	60
1,000	G.E.	75

FREQUENCY CHANGERS AND GENERATORS

Size	Make	Output Frequency
150 KW	G.E.	150 cy.
154 KVA	G.E.	150 cy.
10 KW	G.E.	200/700 cy.
7½ KW	G.E.	408 cy.
5 KVA	West.	400 cy.

ELECTRIC HOISTS

1000# Y & T—D.C.
1000# Thor—Air.
1000# Y & T—A.C.
1000# Shepard—A.C.
2000# R & M—D.C. (3)
2000# C & M—D.C.

GUARANTEE YOUR INVESTMENTS!

- LAND gives 1 year guarantee.
- All equipment listed in stock.
- You can see your machines run and tested under power before shipment.
- Complete shop facilities with thoroughly trained & experienced mechanics (many have been with us over 25 years).
- Responsible Organization —41 years' experience.

Partial List ONLY

L. J. LAND INC. — EST. 1910 — 41st YEAR

156 GRAND STREET — NEW YORK 13, N. Y.

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT WAGNER

BACKED BY 46 YEARS OF QUALITY AND SERVICE

For QUALITY-SERVICE-PRICE - - - "Check with WAGNER First!"

OVER 46 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"

M-G SETS

KW	Mfr.	Input V	Output V
500	Gen. Elec.*	2300 AC	250 DC
500	G.E. HCC conv.	2300 AC	275 DC
300	Allis Ch.	2200/440 AC	125/250 DC
300	Whse.*	2300 AC	600 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	2300 AC	275 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse.*	220/440 AC	250 DC
100	Delco b.b.	220/440 AC	125/250 DC
100	Allis Ch.*	2200/440 AC	125/250 DC
100	Gen. Elec.	220/440 AC	125 DC
75	Whse. (2)	220/440 AC	250 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (3)	220/440 AC	125/250 DC
50	Whse.	2200/440 AC	250 DC
45	Gen. Elec.*	220/440 AC	60 DC
45	Gen. Elec.	220/440 AC	60 DC
40	Whse. (2)	220/440 AC	125 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b.	220/440 AC	125 DC
30	Elec. Prod.	220/440 AC	60 DC
25	Whse.	220/440 AC	125 DC
25	G.E. b.b. New	220/440 AC	125 DC
20	Northw'n.	220/440 AC	250 DC
15	G.E. (2)	220/440 AC	125 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	230	500
200	Gen. Elec.	CD165A	230	850
150	Gen. Elec.	MPC	230	500/1200
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
75	Whse.	SK	230	1150
75	Whse. (2)	SK163	230	850
75	Northw'n	K20	230	1750
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	551T	230	750
50	Gen. Elec.	RLC 204	230	500/1200
50	Gen. Elec.	LC	115	400/800
50	Cr. Wheeler	CMC	230	1750
50	Whse.	SK	230	850
50	Gen. Elec.	RC-32	230	1150
40	Gen. Elec. (2)	CD115	230	575/1150
30/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SK110L	230	1150
30	Whse. (2)	SK90	230	1700
30	Star b.b.	SB	230	1750
25	Gen. Elec.	CD85	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b. New	CDM93	115	1150
25	Gen. Elec.	RF13	230	250/1000
25	Whse.	SK	230	1150
20/25	Whse.	SK160	230	225/900
20	G.E. b.b. (5)	CDM83	230	1150
20	Whse. b.b. (2)	SK97	540	900
20	Gen. Elec. (2)	CD83	230	1750

- **EXPLOSION PROOF MOTORS—**
- **GEARHEAD MOTORS, AC & DC**
- **FREQUENCY CHANGERS**
- **CIRCUIT BREAKERS, AC & DC.**
- **SPEED REDUCERS**

D. C. GENERATORS

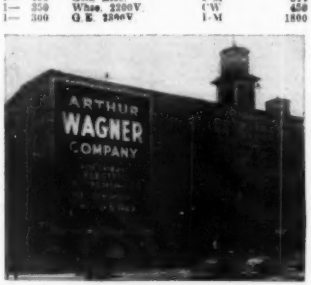
KW	Mfr.	Type	Volts	Speed
300	Whse.	SK	600	900
200	Gen. Elec.	CD	250	1150
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1760 amp.	70	1200
100	Gen. Elec.	C	250	750
75	Whse.	SK	250	1200
75	Gen. Elec.	RC36	250	1200
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	EW	125/250	1200
50	Cr. Wheeler	50H	250	900
40	Whse.	SK	250	1200
40	Gen. Elec. (2)	RC32	250	1500
25	G.E. b.b. New	CDM93	125	1750
25	Whse.	SK	250	1450
20	Gen. Elec. (2)	RC	128	1150
20	Gen. Elec. b.b.	CDM	250	1750
15	Cr. Wheeler b.b.	CVD	125	1100

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	Allis Ch.	3 brg.	240/480	360
312	Gen. Elec.	ATB	240/480	600
300	Gen. Elec.	ATB	600	720
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	2400	900
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	Gen. Elec.	ATB	240/480	1200
31	Whse. b.b.	late	120/208	1200
10	Kato New (2)	b.b.	127/220	1800

A. C. MOTORS — SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr.	Type	Speed
1—	600	Gen. Elec.	IM	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
1—	350	Whse. 2200V	CW	450
1—	300	G.E. 2300V	I-M	1800



1—	250	Allis Ch. 2200V.	ANY	514
1—	250	Cr. Wheeler	SR	600
1—	200	F. Morse b.b. 2200V.	HV-24C	900
1—	200	Gen. Elec.	IM-17	514
1—	200	Gen. Elec.	I-M	360
2—	200	Gen. Elec.	I-M	600
1—	200	G.E. 2300/4400V. Vert.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	150	G.E.	IM-16	600
1—	150	Allis Ch. 2200V.	ANY	720
1—	125	G.E. 2300V.	IM-15	720
2—	125	Gen. Elec.	I-M	600
1—	100	Allis Ch. 3 brg.	ANY	720
2—	100	Gen. Elec.	MT356	900
1—	125	Allis. Ch.	ANY	900
2—	100	Gen. Elec. New	M6324	1200
1—	100	Gen. Elec.	I-M	720
2—	100	Gen. Elec.	I-M	514
1—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT533	1200
1—	100	Cr. Wheeler	SR	600
1—	100	Northwestern	HW	1800
1—	75	Gen. Elec.	MT358	900
2—	75	Gen. Elec.	MT352	900
1—	75	Whse. 2200V.	CW	600
2—	75	Gen. Elec.	MT343	1800
1—	75	Whse.	CW	720
3—	60	Gen. Elec. enclosed	I-M	514
1—	60	G.E. TEFC b.b.	M-6326	720
1—	60	Fair. Morse	BW	720
1—	60	Whse. 2200V.	CW716C	900
1—	50	Allis Ch	ANY	900
1—	50	Gen. Elec. Int.	ITC	600
2—	40	Whse.	CW636A	1200
1—	40	Whse.	CW757	720
1—	30	G.E. Int. duty	MTC5312	1200
2—	30	Gen. Elec.	MT326	1200
2—	30	Gen. Elec.	MT332	900
1—	25	Gen. Elec. Int.	MTC5326	720
1—	20	Whse. b.b. New	CW364	1800

A. C. MOTORS — SYNCHRONOUS

HP	Mfr.	Type	Volts	Speed
750	Whse. SPF	Cond.	4000/2300	900
700	Gen. Elec.	TS7459	2300	514
575	Gen. Elec.	ATI	550	720
500	Whse.	G	2300/440	600
275	G.E. 25 cycle	ATI	220/440	750
225	El. Machy.	BRKT	220/440	1800
220	G.E. 3 brg. SPF	ATI	220/440	600
200	G.E.	ATI	2200	900
200	Allis Ch.	SPF	2200/440	720
200	G.E.	TS	220/440	150
190	El. Machy.	3 brg.	220/440	514
175	Gen. Elec.	ATI	2200/550	450
175	Whse.	2 brg.	220/440	360
150	G.E. b.b. SPF	TS8965	220/440	720
125	El. Machy. (2)		220/440	1800
120	Burke b.b. SPF	AC19	2200/440	1200
100	American b.b.	VGH	220/440	1800
90	Gen. Elec.	TS7545	220/440	1200
80	Gen. Elec.	ATI	2200/440	1200

A. C. MOTORS — SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr.	Type	Speed
1—	500	G.E. 6600/4000 V.	I-K	1800
1—	300	G.E. 2200V.	KTP561	1800
1—	300	Gen. Elec.	IK	600
2—	250	Whse. 2200V.	C8	1200
1—	250	Gen. Elec.	IK-17	600
1—	250	G.E. 2200/440V.	KT412	600
1—	250	G.E. 4000/2200V.	KT412	360
1—	200	Gen. Elec.	IK-17	514
2—	200	Reliance b.b. New	B6085S	1800
1—	200	Gen. Elec.	I-K	600
1—	200	U.S. b.b. New	SC587	1200
2—	200	Gen. Elec.	I-K-213B	1800
1—	200	Whse. 2200V. Ex. Pf.	C8612308	1200
1—	150	Gen. Elec.	K558	900
1—	150	Allis Ch. 2200V.	ABW	3600
2—	150	U. S. b.b. New	SC587	1200
1—	150	Reliance b.b. New	C6085	900
1—	150	Gen. Elec.	KT549	1800
2—	150	Gen. Elec. 2200V.	IK-15A	720
1—	150	Gen. Elec.	IK-16	600
1—	150	Gen. Elec. TEFC b.b.	K6333S	1200
1—	150	Gen. Elec.	IK-17	450
1—	150	Whse.	C8	720
2—	125	Al. Ch. 2200V. b.b	ARX-826	900
1—	125	Rel. TEFC New	B6085S	1800
2—	125	Gen. Elec.	K-558	900
1—	125	G.E. b.b. New	K6324S	1200
1—	125	G.E. New b.b. HT	KG6324	1200
1—	125	Con. 2200V. b.b.	SC	1800
2—	125	G.E. 2200V. TEFC	K6326	3600
1—	125	Reliance b.b. New	B6085	900
1—	100	Reliance b.b. New	5084S	1800
1—	100	Reliance TEFC New	B5085	1200
1—	100	Whse.	C8	720
1—	100	Rel. TEFC New	5058	3600
1—	100	Gen. Elec.	IK-15	600
2—	100	Gen. Elec.	IK-14	900
1—	100	Reliance b.b. New	C5085	900
1—	75	Whse. Expl. Prf.	C8505	1200
1—	75	Wagner	22VRM	1800
1—	75	Rel. TEFC New	5048	3600
1—	75/90	Gen. Elec.	IK	3600
1—	75	G.E. TEFC 2200V.	K-6325	900
2—	75	Gen. Elec.	I-K-14	600
1—	75	Reliance TEFC	C5084	1200
2—	75	U.S. b.b. NEW	SC505	1200
1—	60	G.E. 2200V.	KT533	1800
2—	60	Gen. Elec.	IK-13	900
2—	60	Howell b.b.	K504	1200
1—	60	Gen. Elec.	KT556	450
1—	60	Reliance b.b. New	CC505	900
1—	60	G.E.	KT556	450
1—	60	Gen. Elec.	I-K	600
1—	60	G.E. Vertical	KT536	1200
2—	60	Reliance b.b. NEW	B504	1800
1—	60	Allis Ch. TEFC	ARZ	3600
2—	50	Howell b.b.	SCBB	3600
2—	50	Gen. Elec.	KT546	720
1—	50	G.E. Vertical	KT546	720
2—	50	Reliance b.b. New	CC504U	900
1—	50	Whse	C8	1200
1—	50	Howell TEFC	K445	1800
1—	50	Gen. Elec.	KT527	1800
1—	50	Reliance b.b.	C585	600
1—	50	Whse. hiterq	C8505	900
2—	40	G.E. 2200V.	KT323	1800
2—	40	Reliance b.b. New	CB404	1800
2—	40	Louis Allis b.b.	OX404	3600
2—	40	Gen. Elec.	KT533	1800
4—	40	Gen. Elec.	KT336	900
2—	40	Gen. Elec.	KT346	600
6—	40	Whse. b.b.	C8-504	1200/900

A. C. MOTORS — 25 CYCLE

HP	Mfr.	Type	Volts	Speed
275	G.E. syn.	ATI	440	750
150	Whse.	HF	440	500
60	Allis Ch.	ARY	440	1500
50	Gen. Elec. Int	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
30	Gen. Elec.	MT343	440	750

QUICK SHIPMENT FROM STOCK--
LOW PRICES — FULL GUARANTEE
Send for Complete Stock Lists

ELECTRICAL EQUIPMENT

REBUILT AND GUARANTEED

PROMPT SHIPMENT — PARTIAL LISTING

Electrical Equipment—Rebuilt and Guaranteed—Motors—Generators—M-G Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed—Motors—Generators—M-G Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed

800/1600 AMPERE ARC WELDING MOTOR GENERATOR SETS

Each set consists of two generators and one motor, mounted on base. Each Generator: Northwestern Type K250R, 800 ampere, 50 volts, 1750 RPM. Motor: 125 HP, Allis Chalmers, Type AR, 2200 volts, 3 phase, 60 cycle, 1750 RPM.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-520
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	400	F-M	HV-H16A
1	40	895	2200	Al. Ch.	ARY-223C
1	40	560	440	G.E.	MT-345
1	50	1150	440	G.E.	MT-536
1	50	860	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
1	200	495	2200	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
1	300	900	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
1	500	505	550	West.	CW
1	600	1770	440*	G.E.	IM-E15C
1	700	735	4000‡‡	West.	CW

220 volt meters can be reconnected for 440 volts. ‡Intermittent rating. ‡‡25 cycle.
**New †Also 440 or 550 volts.
*Also 2300 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding. Direct Connected Exciter.

Qn.	KVA	RPM	Make	Volts
3	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	B A-324
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-83
10	11½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
3	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20**	1450	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
2	20**	1450	G.E.	CDM-83
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
1	150	¢ 700	Al. Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West.	SK-153
1	25	600/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30/40**	400/1800	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1200	West.	SK-163
1	75	375/750	Cr. Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al. Ch.	
1	100	320/980	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/900	West.	SK-220
2	375	350/500	G.E.	MPC

**New

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
3½	3	1160	440	L.A.	JS-254
4½	5	1730	440	G.E.	K-254
2	7.5	1740	440	G.E.	K-284
1	10	1735	440	West.	CS-324
1½	10	1140	440	Wagner	CP2-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1½	40	3565	440	G.E.	KF-4058

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
4	15	1150	440	L.A.	FX-365
1	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qn.	HP	Speed	Volts	Make	Type
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RP1-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KT-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-326***
1	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
1	30	3550	550	G.E.	K-3648
1	30	1755	220	G.E.	FT-513
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
2	60*	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
2	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-352B
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.Ch.	AN
1	100	435	440	Al.Ch.	AR
1	125	400	2300	G.E.	I-17-FR
2	125	580	550‡‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	500	1200	140	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D12

220 volt motors can be reconnected for 440 volts. **New. ***2 Phase. ‡‡Reconnectable for 440 volts.

250 VOLT DYNAMOMETERS

Cradle Type With Scale and Control

Qn.	Make	HP	RPM	Type
1	G.E.	150	0200/5000	TLC-50
2	West.	150	2 0/5000	SK-131
1	G.E.	200	00	C

MOTOR GENERATOR SETS

125 and 250 Volts D.C.

(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1750	125	220/440
15**‡	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
151	West.	1450	125	220/440‡
16	West.	1750	125	2200/440
25	G.E.	1200	125	220/440
30	Al. Ch	1750	125	220/440
50‡	G.E.	1720	125	220/240†
75	G.E.*	1200	125	220/240
100*	West.	1160	125/250	2300/4160

Note: 3KW, 5KW & 7.5KW, 250V Sets Available.
**New. *Synch. Motor Driven. ‡50 Cy. †25 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment Is Located In Our Cleveland Warehouse. We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

AMERICAN

SINCE 1902

COMPRESSORS
VACUUM PUMPS
BEST BY TEST
YOUR CHOICE:
American—Bury—Chicago—
Curtis—Davey—Gardner
Ingersoll—LeRoi—
Penn—Schramm—
Sullivan—Worthington

HEAR-HERE
American Rebuilts
Are Best

AMERICAN AIR COMPRESSOR CORP.
Dell Ave., & 47th North Bergen, N. J.

MOTOR GENERATORS

2—300 KW (DUPL.) G.E. Syn. 250 V. 1200 RPM
2—300 KW (DUPL.) WEST. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW RIDGWAY Syn. 250 V. 900 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
1—100 KW RIDGWAY Syn. 250 V. 1200 RPM
2— 50 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS

2—500 KW WEST. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
3—300 KW AL-CH. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

BOILERS

100,000 lbs. per hr. 250¢ Integr. Furnace
87,000¢ high effic. Steam Generator 350¢
2—777 HP. 225¢, 4 drum, Bent Tube
1—600 HP. 200¢, B&W Sterling
3—300 HP. 175¢, Box Header type

TURBO GENERATORS

4000 KW. 300¢ Bleeder Type Condensing
2500 KW. 225¢ Non Condensing

DIESEL PLANTS

1200 KVA (in 3 units) 514 RPM, 440 v.
2—300 KW. 450 RPM. 6 cyl. 2300 v.

STEPHEN A. DOUGLASS CO.
610 Fort Washington Ave. New York 33, N. Y.

---

500 KW GE SYNCHRONOUS CONVERTERS HCC6 (2)

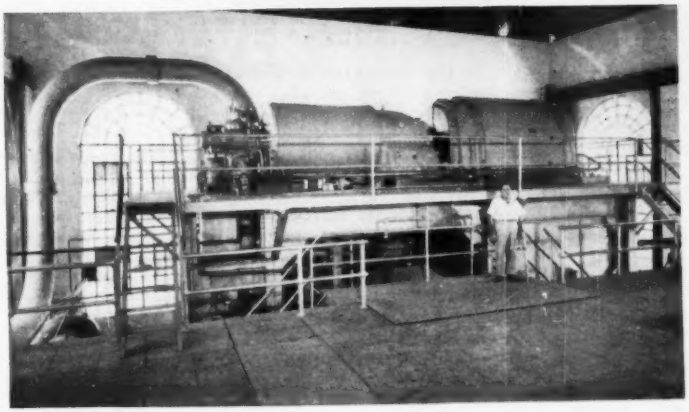
220/280 V. DC Booster Type 1200 RPM Six Ph. Ped. Bear. Manual Control, Trans. to suit.

S. M. DAVIS
510 LaSalle St. St. Louis 4, Mo.

AVAILABLE NOW!!!

6250 KVA TURBO-GENERATOR Condensing

Allis-Chalmers
3600 RPM
Now 200 lbs
100° SH
Can use
without
change at
275 lbs
200° SH



3/60/11500
GENERATOR
We can
make
voltage
change
to suit
customer

Inspected by factory service engineer in September this year—absolutely no repairs necessary. Condenser recently retubed—complete auxiliaries. Shut down only because power requirements increased to point where purchased power more advantageous. CAN BE SEEN IN OPERATION.

ALSO IN OUR STOCK

1250 KVA 3600 rpm 3/60/2400 Westinghouse condensing turbo-generator. Competely overhauled by us—new generator winding—top condition. 175 lbs. Complete auxiliaries. Immediate shipment.

1565 KVA 3600 rpm 3/60/2300 Allis-Chalmers condensing turbo-generator. 140 lbs. design—suitable for 200 lbs. 450° TT without change. Good condition.

937 KVA 3600 rpm 3/60/2300 General Electric condensing turbo-generator. 150 lbs. design—new condenser—available—good condition.

SUBSTATION EQUIPMENT—Galvanized Steel Substation Structure—rectangular bay 28' x 30' outside x 25' high. Was used for 2 incoming and 2 outgoing 33 KV lines. New 1937—shows no deterioration. Detailed drawings available.

OUTDOOR SWITCH HOUSES: 3—500 amp. 7500 v. Gen. Elec. OCB 125 v. D.C. solenoid operator, 220 v. A.C. rectox, reclosing relay, overcurrent relays, ammeter, auxiliary relays, complete. 1—Type G-1 Westinghouse 2300 v. Type F22 400 amp. OCB, 110 v. A.C. motor operator, reclosing relay, overcurrent relays, ammeter, auxiliary relays, complete. 1—Type B-1 Westinghouse 11500 v. Type B2 600 amp OCB, 125 v. D.C. solenoid operator, CT's and PT's. OCB in these switch houses can be changed and modifications made to your specifications.

OUTDOOR HORN GAP SWITCHES: 12—33 KV HiVoltage Equipment Co. also 2—24 v. D.C. motor operators. 6—7.5 KV 400 amp. Gen. Elec. Type TA-101.

OUTDOOR DISCONNECTS: 18—7.5 KV 400 amp. Gen. Elec. Type FA-1. 9—15 KV 200 amp. Gen. Elec. Type FD103.

OUTDOOR BUS SUPPORTS: 18—33 KV tubular bus. 40—7.5 KV tubular bus.

Considerable quantity other disconnects, fused cutouts, bus swoparts, insulators, clamps & fittings—both outdoor and indoor. SEND US YOUR INQUIRY.

TRANSFORMERS
2—1000 KVA 13800/2300 1 ph. 60 cy Gen. Elec.

AIR COMPRESSORS
22"—14"x16" Ingersoll-Rand Imperial Type 10 with intercooler. Flat belt short center drive. Latest type channel valves. Horizontal, 2 stage.
20"—12"x14" Chicago Pneumatic Type 0-CB with intercooler. Flat belt short center drive. Horizontal, 2 stage.

MOTORS
400 HP 1800 rpm 3/60/2300 Westinghouse synchronous
360 HP 350 rpm 3/60/2300 Gen. Elec. slip ring
290 HP 720 rpm any voltage Gen. Elec. synchronous
200 HP 1800 rpm 3/60/440 Gen. Elec. slip ring
200 HP 1800 rpm 3/60/440 Gen. Elec. slip ring
160 HP 1200 rpm 3/60/440 Century sq. cage
100 HP 900 rpm 3/60/2300 Gen. Elec. slip ring
100 HP 1800 rpm 3/60/2300 Westinghouse sq. cage
75 HP 1800 rpm 3/60/2300 Westinghouse slip ring
60 HP 1800 rpm 3/60/220-440 Westinghouse sq. cage
50 HP 720 rpm 3/60/2300 Gen. Elec. slip ring
50 HP 720 rpm 3/60/2300 Gen. Elec. sq. cage
Many other sizes in stock.

STEAM ENGINE GENERATORS
(2) 65 KVA Engberg 9x10 Vertical 327 rpm 175 lbs. ga. non-condensing 3/60/220

DIESEL ENGINE
350 HP 400 rpm Superior Type YLO 5-Cyl. 12½x15
Can furnish generator to your specifications.

MOTOR-GENERATORS
1000 KW 600 v. 514 rpm—1440 HP Syn. motor, Westinghouse
(2) 300 KW 600 v. 900 rpm—450 HP Syn. motor, Westinghouse
105 KW 70 v. 1200 rpm—160 HP 220/440 v. sq. cage motor, Century
75 KW 125 v. 1200 rpm—125 HP sq. cage motor, Gen. Elec.
48 KW 30 v. 600 rpm—75 HP sq. cage motor, Gen. Elec.
Also smaller sizes available.

CONDENSERS
(2) 725 sq. ft. C. H. Wheeler 2 pass shell & tube (NEW)

D.C. CARGO WINCH CONTROLLERS
(2) 50 HP 230 v. Class 8590 Westinghouse (NEW)

PIPE LINE PUMPING SETS
17000 bbl. 750 lbs. Goulds 3"—6 stage driven by 300 HP 400 rpm Superior diesel engine.—Falk speed increaser
27000 bbl. 720 lbs. Cameron 4"—6 stage driven by 400 HP 1800 rpm 2300 v. Westinghouse synchronous motor

SPEED INCREASER
8.89/1 Falk 400/3550 rpm 350 HP

BOILER FEED PUMPS
375,000 lbs./hr. 720 lbs. Ingersoll-Rand 4"—6 stage with 400 HP 1800 rpm 2300 v. syn. motor
350,000 lbs./hr. 450 lbs. Goulds. Fig. 3380 4"—4 stage
225,000 lbs./hr. 750 lbs. Goulds. Fig. 3360 3"—6 stage

TAMPA ARMATURE WORKS INC.

401 S. MORGAN ST. PHONE 2-1966 TAMPA, FLORIDA

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—15630 KVA G.E. Cond. 60 cy. 13200 V. 275-lb.
1—10000 KVA G.E. Cond. 25 cy. 6600 V. 200-lb.
1— 6250 KVA Allis Cond. 60 cy. 4000 V. 175-200 lb.
1— 500 KVA West. Cond. Extr. 60 cy. 480 V. 385 lb.
1— 3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V 150-200 lb. 40-lb. BP
1— 2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200 lb. Steel Valve Chest
2— 2250 KVA G.E. Cond. 60 cy. 240-480 lb.
1— 1875 KVA West. Cond. 60 cy. 2300 V. 170-lb.
1— 1875 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 1563 KVA G.E. Extr. Cond. 60 cy. 2300 V. 200-lb
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
1— 938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 938 KVA West. Extr. Cond. 60 cy. 2300/4100 V. 200-lb.
1— 750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 625 KVA West. Cond. 60 cy. 480 V. 150-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 260-lb. 5-lb. BP

DIESEL ENGINE UNITS

2—1700 HP Gen. Motors 2300 V. 60 cy.
1—1000 HP Fair. Morse 2300/4150 V. 60 cy.
1— 900 HP Amer. Loco. 250 V. DC
1— 650 HP Amer. Loco. 448 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS

1—675 KVA Chase Corliss 2300 V.
1—250 KVA Ames Vertical Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	225/285	13800	300
1	1500	G.E.	600	4150	600
3	1000	G.E.	600	13200	900 Auto.

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
1	1500	G.E.	4800	900
1	1500	West.	2300	900

COMPLETE DIESEL PLANT

2—1250 KVA General Electric, 3/60/2300 V. 720 RPM generators coupled to General Motors 1700 HP Diesel engines. Complete with all auxiliaries. Still on foundation.

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
2	4500	Multi Anode	600	13800
1	1000	Multi Anode	600	13800

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	2000	G.E.	600	4000	450
1	1500	G.E.	600	4150	600
2	1000	West.	660	4150	900
1	500	West.	125	2300	720
1	200	West.	275	2200	900
2	150	G.E.	250	2300	1200
1	150	West.	275	440	900
1	75	West.	125	440	1200

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
2	780	West.	2300	200
1	600	G.E.	2300	1800
1	600	G.E.	440	360
1	300	G.E.	2300	600
1	300	West.	2300	900
1	250	Cr. Wh.	440	300
1	115	West.	440	1200

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	5000	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
1	2500	G.E.	25/62½	750
1	1700	West.	60/24	720
1	1250	G.E.	25/60	300

TRANSFORMERS — 60 CY.

1— 3333 KVA West. 132000—7620/13200 Y
1— 75 KVA A.C. 66000/24000—7200/12470 Y
1— 2500 KVA G.E. 59/73 KV—5 taps, 3 ph.
4— 2500 KVA West. 44000—11000
3— 1500 KVA Wag. 44000—6900 NEW
1— 1000 KVA West. 44000—11000
1— 100 KVA Wag. 44000—7200
3— 100 KVA G.E. 44000—2300
3— 75 KVA West. 44000—7200/12470 Y
3— 8333 KVA West. 43800—13800
3— 100 KVA Wag. 36000—11000, 3 ph.
1—18750 KVA A.B.B. 34840—11000, 3 ph.
3— 167 KVA G.E. 33000—2300/4000 Y
6— 150 KVA G.E. 34500—2300/4600
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
3— 50 KVA G.E. 33000—2300
4— 450 KVA A.C. 25410/44000—13280/23000
4— 750 KVA Wag. 19050/33000 Y—6900/11950
3— 600 KVA G.E. 13800/6900—480
3— 480 KVA G.E. 13800/6800—480
3— 200 KVA G.E. 11500—220/110
3— 200 KVA Mol. 11000—2300
3— 100 KVA West. 7200/12470 Y—2400
4— 50 KVA G.E. 7200/12470 Y—2300
3— 500 KVA P.&B. 6900/11900—550
3— 333 KVA Pitts. 6900/11900—550
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900/11900—2400
1— 100 KVA G.E. 2300—575, 3 ph.
6— 50 KVA West. 2400—115/230 DRY TYPE
3— 15 KVA Stand. 450/225—117

OIL CIRCUIT BREAKERS

1—600 A. 73 KV G.E. FHKO-236-500 Outdoor
1—400 A. 37 KV G.E. FHKO-136-350 Outdoor
1—400 A. 37 KV G.E. FHKO-236-500 Outdoor
4—600 A. 15 KV G.E. FHKO-139-750 Outdoor
2—600 A. 15 KV G.E. FHKO-136-1328BS Outdoor
1—1200 A 15 KV G.E. FKO-139-350 Outdoor
1—600 A. 15 KV G.E. FKO-139-350 Outdoor

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BREW-WOLTMAN & CO., INC.

50 Church Street New York City 7, WOrth 4-1470

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS OIL COOLED AIR COOLED PHASE CHANGES

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS REWOUND REBUILT RECONDITIONED

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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Jackson, Miss.

INVENTORY OF BRAND NEW MOTORS IN STOCK

Distributing: G.E., U.S., Crocker-Wheeler, Reliance, Baldor, Marble-Card, A.C.E.C., Diehl
Many Additional Ratings Are Also Available. Every Motor Carries Factory One Year Guarantee.

3 phase 60 cycle 220/440 volt

	3600			1800			1200			900	
H.P.	Open	TE	XP	Open	TE	XP	Open	TE	XP	Open	TE
½				19	4		1	8			
¾	1			23	15						
1	2	1	1	11	7	2	10	5			1
1½	3	1	1	9	14	4	10	2	2		6
2	3	2		22	4	7	18	3	1	2	
3	4	1	1	17	2	2	7	4		4	
5	3			14	3	2	8	2	3	5	
7½	3	1	1	28	6	2	12	3		5	
10	1			28	3	2	4	3	2	2	
15	1			10	3	1	3			2	
20	1			9	4	1	6			1	
25				1		1	1				
30				4			1				
40				1			2				
50				1							

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SANDMAN Electric

SANDMAN ELECTRIC CO., INC.
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We own and offer the following types of equipment now located at our warehouse:

B&W Boilers—300 and 500 H.P., 200 lbs.
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Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

BOILER & EQUIPMENT CO.
743 Bedford Ave. Brooklyn 5, N. Y.
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There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

A.G. SCHOONMAKER CO., INC.

52 CHURCH ST., NEW YORK 7, N. Y.

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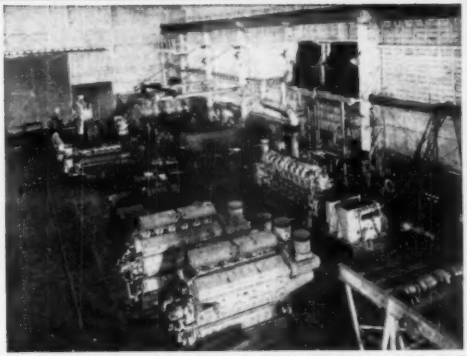
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1230	Nordberg	F6G168SC	1750	327
1136	Fairbanks Morse	38D	1600	720
1000	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
500	Alco	6-12-1/2x13T	750	600
500	Worthington	EE	750	327
500	General Motors	8-567	720	720
340	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
300	Enterprise	DSG-6	450	450
300	General Motors	8-268A	450	1200
264	Superior	KNA	396	514
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200
50	Caterpillar	D-8800	76	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

TURBO GENERATOR UNITS
3 Phase 60 Cycle

25000 KVA G.E. Cond. 13200 V. 250-lb.
6250 KVA A. Ch. Cod. 4160 V. 200-lb.
5000 KVA G.E. Non-cond. Extr. 13800 V. 600-lb.—125-lb. Extr. 50-lb. Exh.
5000 KVA West. Cond. Extr. 600 V. 300-lb.—25-lb. Extr.
2500 KVA G.E. Cond. 2300 V. 150-lb.
1562 KVA A. Ch. Non-cond. 480 V. 200-lb.—15-lb. Exh.
1250 KVA West. Cond. Extr. 480 V. 200-lb.—25-lb. Extr.
625 KVA West. Non-cond. 480 V. 200-lb.—10-lb. Exh.

BOILERS

50000 lbs. B. & W., 400 lbs.
30000 lbs. B. & W., 400 lbs.
17000 lbs. Cleaver-Brooks, 200 lbs.

ENGINE GENERATOR UNITS
3 Phase 60 Cycle

750 KVA Ames vert. Uniflow 2300 V.
625 KVA Skinner Uniflow 240 V.
312 KVA Skinner Uniflow 240/480 V.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1250 KVA Nordberg, 2400 V. 257 rpm.
700 KVA Fair.-Morse, 2400 V, 300 rpm.
600 KVA Fair.-Morse, 2400 V. 300 rpm.
475 KVA Coop.-Bess., 2400 V. 400 rpm.
375 KVA Chic.-Pneu., 2400 V. 257 rpm.

GAS ENGINE UNITS
3 Phase 60 Cycle

1000 KVA Rath.-Jones, 2400 V. 225 rpm.
600 KVA Superior, 480 V. 327 rpm.
438 KVA Superior, 480 V. 400 rpm.
219 KVA Rath. Jones, 240 V. 257 rpm.

TRANSFORMERS
1 Phase 60 Cycle

3—1000 KVA G.E. 13200/2300 volts
3— 667 KVA Pitts. 13200/2300 volts
3— 500 KVA Pitts. 11500/550 volts
3— 500 KVA West. 13200/2300 volts
3— 200 KVA G.E. 13200/2300 volts
3— 100 KVA Pitts. 12500—120/240 volts

RECTIFIERS
3 Phase 60 Cycle

4500 KW A. Ch. 13800—600 V. DC
1500 KW West. 44000—1500 V. DC
1000 KW G.E. 13200—600 V. DC
750 KW G.E. 44000—1500 V. DC

GENERATORS
3 Phase

2250 KVA G.E. 60 cy. 480 V. 3600 rpm
2859 KVA (3) G.E. 240 cy. 2300/4150 V. 4800 rpm.

INTERNATIONAL POWER MACHINERY CO.

1609 UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	MAKE	TYPE	SPEED	DESCRIPTION	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
400	G.E.	I-M	1200	S. B.	100	G.E.	I-M	720	S. B.
300	G.E.	I-M	1200	S. B.	75	G.E.	MT-343	1200	S. B.
200	G.E.	I-M	1200	S. B.	75	G.E.	I-M	900	S. B.
150	G.E.	I-M	1200	S. B.	75	West.	CW	720	S. B.
150	G.E.	I-M	1800	S. B.	75	G.E.	I-M	720	S. B.
100	G.E.	MT-300	1800	S. B.	60	G.E.	MT-333	1800	S. B.
100	G.E.	I-M	900	S. B.	40	G.E.	I-M	1800	S. B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-607S	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	CS-504S	1800	TEFCBBXP
60	G.E.	K-5949	1800	TEFCBBXP
60	L.A.	0G-44	1800	B. B. open
60	F.M.	QS-444	1800	B. B. open
50	Master	FB-404	3600	TEFCBBXP
50	G.E.	K-445	1800	TEFCBB
50	G.E.	K-405	1800	S. B. drip
50	West.	CS-445	1200	S. B. open
50	G.E.	K-505	900	TEFCBBXP
40	A.C.	AR-444	3600	TEFCBBXP
40	G.E.	KF-365S	3600	B. B. splash
40	West.	CS-405	1800	TEFCBB
40	L.A.	K-403	1800	TEFCBBXP
40	G.E.	404	1800	B. B. open
40	Cr. Wh.	BC-445	1200	TEFCBB
30	G.E.	KF-365S	3600	B. B. splash
30	West.	CS-365S	3600	S. B. splash
25	Line.-Weld	DBD-329	3600	B. B. open
25	West.	CS-364	1800	S. B. splash
25	G.E.	K-364	1800	S. B. drip
25	G.E.	K-364	1800	S. B. drip
20	L.A.	EX-364	1800	TEFCBBXP
20	G.E.	KF-404	1200	TEFCBBXP
20	G.E.	KG-405	900	TEFCBBXP
20	G.E.	KF-405	900	TEFCBBXP
15	L.A.	EX-326	1800	TEFCBBXP
10	West.	CS-284Z	3600	TEFCBB
10	Howell	EKBB-28-5	1800	TEFCBBXP
10	Reliance	AA-CB-324	1800	TEFCBB
10	West.	CS-324	1800	TEFCBB
10	West.	CS-324	1800	B. B. open
10	L.A.	EX-326	1200	TEFCBBXP
10	G.E.	K-364	900	S. B. drip
10	L.A.	R-1838	600	TEFCBB
3	G.E.	K-224	3600	TEFCBBXP
3	L.A.	EX-225	1800	TEFCBBXP

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	S. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-807	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.
50	G.E.	KT-312	900	S. B.
50	G.E.	KT-346	900	S. B.
40	G.E.	K-444	1800	B. B.
40	G.E.	KT-323	1800	S. B.
40	West.	CS	1200	S. B.
40	G.E.	KT-336	900	S. B.
40	F.M.	B-H12D	900	S. B.
40	G.E.	KT-342	720	S. B.
35	Triumph	B-12	900	S. B.
35	G.E.	I-L	900	S. B.
35	G.E.	I-K	720	S. B.
30	G.E.	KT-312	1800	S. B.
30	West.	CS	1200	S. B.
30	G.E.	KT-332	900	S. B.
25	G.E.	KT-312	1800	S. B.
25	West.	CS-471	1800	S. B.
25	Century	SC-30	1200	S. B.
25	G.E.	I-K	720	S. B.
25	F.M.	B-H12-B	720	B. B.
20	West.	CS-364	1800	S. S. B. splash

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER EQUIPMENT COMPANY

8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.

Telephone: Genesee 5629

375 KVA - FOR SALE - 300 KW

WORTHINGTON-WESTINGHOUSE INSTALLATION

COMMERCIALLY UNUSED

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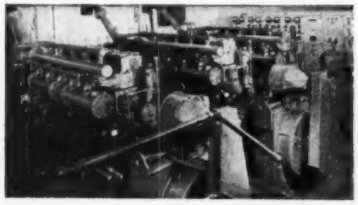
IMMEDIATE DELIVERY



Each Plant consists of

3 Worthington Model 88 5—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.

Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.

Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.

Complete with all accessories and auxiliaries including evaporative coolers—switch board—distribution panel.

OWNED & OFFERED BY

KANE-McGUIRE COMPANY

Single units available

1492 East 32nd Street
Brooklyn, New York
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COMPRESSORS AIR or GAS

GUARANTEED REBUILT

All Types and Sizes

Motor and Steam Drive

Also:—Aftercoolers, Air Receivers, V-Belt Drives.

EARL E. KNOX CO.

1107 BACON ST. ERIE, PENNA.

BOILERS

10 to 5000 H.P.

Diesel, Steam Turbine, Engine

GENERATORS

Heavy Power Equipment
Industrial — Chemical Process Equipment

NEW — RECONDITIONED — USED

DEAN G. STRICKLER & ASSOCIATES

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Washington 6, D. C. • DuPont 3386

MOTORS - M.G. SETS - CONTROLS

NEW AND GUARANTEED REBUILT

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
600	1800	2300	G.E.	100%
400	900	2300	Whse.	80%
250	200	440	G.E.	85%
200	900	440	E-M	80%
150	600	440	G.E.	100%
150	900	2300	G.E.	100%

SLIP RING

HP	RPM	Volts	Mfg.
700	514	2300	G.E.
500	1200	220/440	Elliott (new)
350	450	2300	Whse.
300	600	220	G.E.
200	450	2300	Burke
100	1160	440	G.E.
75	720	220	G.E.
50	720	220	Whse.
50	900	220	G.E.
40	900	220	G.E.

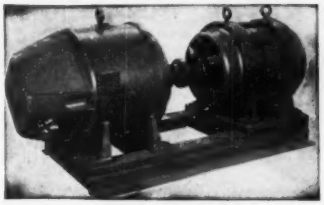
NEW DIRECT CURRENT

230 volt-dripproof

Qu.	HP	RPM	Mfg.	Frame
1	2/3	690/2660	G.E.	284
10	5	850/1700	G.E.	CD-66
3	7½	575/1725	G.E.	CD-77
1	7½	1750	Rel. (TE)	14T
1	10	575/2300	L.A.	4051
1	30	300/1800	G.E.	CD-1377

CRADLE TYPE DYNAMOMETER

225 HP, Whse, 250 v. DC, 300/2000 RPM, complete with Toledo automatic printing type scale and all necessary control.



M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
250	240	2300	G.E.
150	250	440	Whse.
100	275	2300	Whse.
50	250	440	G.E.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
15	230	220/440	G.E.
7½ VS	250	220/440	Rel.
3 VS	250	220/440	Rel.

NEW MAGNETIC SLIP RING CONTROL

1—ALLIS 250 HP, 440 volt (125 HP, 220 volt) Reversing, 7 accel. steps, main line air ckt. brkr., fully magnetic, open or enclosed.

230 V. DIRECT CURRENT

Reconditioned & Guaranteed

HP	RPM	Mfg.	Brgs.
100	450/1350	Whse	SI.
65	400/1200	Rel.	SI.
50	300/900	G.E.	SI.
50	500/1500	G.E.	SI.
40	400/1200	Rel (TE)	Ball
35	400/1200	Ideal	SI.
30	250/1000	Whse.	S.SI.
30	500/1500	C-W (TE)	BB
30	500/1500	Rel	Ball
30	600	Whse.	SI.
25	250/1000	G.E.	SI.
25	500/1500	C-W	Ball
25	600/1350	Rel	Ball
25	690	Rel	Ball
20	250/1000	Whse.	SI.
20	300/1200	Rel.	Ball
20	500/1500	G.E.	SI.
15	250/1000	G.E.	SI.
15	400/1600	Whse.	SI.
15	575/1725	L.A.	Ball
15	650/1650	G.E.	SI.
15	700/1350	Rel	Ball
10	300/1200	Whse.	SI
10	400/1600	Rel	Ball
10	600/1200	Rel (TE)	Ball
10	850	Rel	Ball
10	1750	G.E. (TE)	BB
7½	200/1200	Whse. (TE)	Ball
7½	300/900	G.E.	SI.
7½	400/1600	Rel	SI.
7½	400/1600	Whse.	Ball
7½	600/1800	Rel (TE)	Ball
7½	1150	G.E.	SI.
5	400/1200	C-W	SI.
3	850/1700	Rel	Ball

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 — AKRON 9, OHIO

FOR SALE

(NEW) HEAT CONTROL AND RECORDERS

3 Wheelco Capacilogs—Model #702

1—Range 0—600 C. Degrees.
1—Range 0—1200 C. Degrees.
1—Range 0—1600 C. Degrees.

New in original crates

Spot Delivery—No Priority

KINGS COUNTY MACHINERY EXCHANGE

408 Atlantic Ave., Brooklyn 17, N. Y.
Phone — TR 5-5237

FOR SALE

1—240 KVA Ames Uniflow Steam Generating Unit

1—250 h.p. 12 cylinder GMC Diesel engine, mounted on steel I-Beams with V-Belt drive

120-180-240-360-600-up to 1500 h.p. Fairbanks - Morse Diesel Generating Units

1—300 h.p. Vern Severin Diesel Generating Unit

A. C. ASKEW

BOX 3073, WHITTIER STATION
TULSA 8, OKLAHOMA

ONE COMPLETE BOILER PLANT

CONSISTING OF THE FOLLOWING:

2—250 H.P. Union Iron Works Package Boilers, 50° superheat.

2—Detroit Roto Stokers, two feeder units, each with drives.

2—American Blower Fans and Drives.

2—Boiler Feed Pumps.

Hays Combustion Control.

Jeffrey Coal Handling System.

Ash Conveyor.

Boiler Room Piping and Connections.

NEW (OPERATED LESS THAN 1 YEAR)

2—250 H.P. Horizontal Straight Tube Union Boilers.

1— 72 H.P. Titusville Firebox Return Tubular Boiler.

JAMES T. CASTLE CO., INC.

534 FIRST AVE., PITTSBURGH 19, PA.

This Seal JLHP ...tells you what you buy is GOOD EQUIPMENT!

GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1500	Whse.	Hipersil	3	66000/33000 prt., 240/480 sec. w/Tap
1	1500	GE	Pyranol	3	4150x2300V
1	500	Kuhl.	OISC	1	4600x2300V
1	300	Pitts.	ODSC	1	7800x448V
1	200	GE	HT	3	2300x220
1	200	Whse.	Auto	3/3	4150x2300
1	200	Pitts.	OISC	1	4000x110/220
1	200	GE	Auto	3/3	4150x2400
1	100	Pitts.		1	2750x110/220
3	100	Wagner	RCKV	1	240x120/120
6	50	GE	H	1	13,750x125/216Y
2	37½	A. Ch.	AD	1	450x120
2	25	G.E.	H	1	11,500x230/460

SPECIAL—WELDING MOTOR GENERATOR SET

1—176 KVA Whse. Welding Gen. Set, 1 Ph. 20V. 800 Amp 57% PF with Slip Ring Motor & Exciter

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	GE	514	600	2300/4150 syn
1	300	GE	1200	250	2300 Syn.
1	200	Whse.	900	250	220/440 Syn.
1	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El. Mach.	1200	125	4150 Syn.
1	100	GE	900	250	2300 Syn.
1	94	GE	1200	60	440 SC
3	94	GE	1200	60	4150 Syn.
1	75	Cr. Wh.	1200	250	4150/2300 syn
7	10	El. Mach.	1750	125	440 SC

SYNCHRONOUS

300 HP El. Mach. 720 RPM 2300 V T E F. C. outdoor Service

200/100 HP Whse. 720/360 RPM 4150 V.

SLIP RING

1	2500	GE	MT	4600	257
1	250	Whse.	CW	440	600
1	200	GE	MT	2300	1000
1	200	Whse.	CW	440	600
1	200	GE	MT	440	600
1	100	GE	IM	440	600
1	75	GE	MT	220	1500 Vert
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1300

"FOR POWER"
J.L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 3-2600

Member of The National Industrial Service Association, Inc.

TURBO-GENERATORS

2000 K.W., 3 ph., 60 cy., 150 lbs G.E.
1000 K.W., 3 ph., 60 cy., 250 lbs G.E.
750 K.W., 3 ph., 60 cy., 200 lbs extract. G.E.
500 K.W., 3 ph., 60 cy., 150 lbs G.E.
150 K.W., 250 v. new Westgh., D.C.

DIESEL UNITS

62½ KVA., 3-60-220-440 v., Caterpillar
37½ KVA., 3-60-220 v., Ready Power
100 K.W., 250 v., D.C. Superior Delco

UNUSED PUMPS & MOTORS

Union Steam Co., pumps all 250 ft. head with new Louis Allis motors, 1750 rpm.
1—400 GPM, 50 HP motor
1—500 GPM, 75 HP motor
1—900 GPM, 100 HP motor

TRANSFORMERS

1—600 KVA., 3 ph., 13800 x 575
1—500 KVA., 3 ph., 11500 x 460
2—500 KVA., 13800 x 2300
7—100 KVA. Gen. Elec. 11000 x 2200 v.
3—100 KVA., Moloney 11400 x 2200 v.
4— 50 KVA., Gen. Elec. 11000 x 2300 v.
2— 50 KVA., Westgh. 13800 x 230—460 v.
100—Transformers late type pocket bushings 12000-11500 x 120-240

3 PH., MOTORS

425 HP., Gen. Elec. MT414Y, 392 rpm., Slip rg.
300 HP., Gen. Elec. 257 rpm., syn.
200 HP., Gen. Elec. IM,—585 rpm., Slip rg.
200 HP., Westgh. CW., 1750 rpm., Slip rg.
200 HP., Gen. Elec. IM., 435 rpm., Slip rg.
200 HP., Gen. Elec. KT559, 1150 rpm., Sq. cage
150 HP., Gen. Elec. IM., 1800 rpm., Slip rg.
150 HP., Gen. Elec. IM., 514 rpm., Slip rg.
100 HP., Gen. Elec. IM—370 rpm., Slip rg.
100 HP., Gen. Elec. IM—585 rpm.
100 HP., Westgh., 900 rpm., Syn
100 HP., Gen. Elec. KT543, 1800 rpm., Sq. cage
100 HP., Elec. Mchy. 300 rpm., syn.

SUB STATION

2—400 amp., 3 pole 15000 volts FO24 Westgh. electrically operated breakers disconnects etc.

We carry a large stock of all kinds of direct current motors etc. What have you for sale? What do you need?

KEYSTONE POWER PLANT EQUIPMENT CO.
8403 Hegerman St. Phila. 36, Penna.

John H. Benson Roy L. Wilimzig

MOTORS!! PUMPS!!
TRANSFORMERS!!

3—833 KVA Westinghouse transformers OISC, 1 ph., 2400/4160Y to 480 volt, Type SL, Ser. 2-150,000
1—200 HP, 600 RPM, GE, Slipring IM, Frame 17, 3/60/220/440
1—150 HP, 514 RPM, Westinghouse Slipring, Type HF, 3/60/220/440
1—200 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT
1—125 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT
1—200 KW MG set, 125 V. DC, 900 RPM Synchronous drive, 3/60/2300 E.C. Factory Set.
2—24x24 Dayton Dowd C324, 16,500 GPM, 18.5/35 FT. HD., 360/450 RPM

Phone, Write or Wire!

BENSON-WILIMZIG, INC.
formerly C & S Machinery Co.
1708 N. 8th St. St. Louis, Mo.
GA-4290

SELLING FOR CUSTOMERS

2—100 KVA, 1 phase 60 cycle 2400 to 240/480 Pyranol trans.
1—50 1—100 & 1—150 KW M.G. Set 220/440 AC to 250 DC.
1—375 KVA Westinghouse noncond. turbine set.
1—37½ KVA 240/480 Diesel set.
What do you need—What have you to sell—Make use of our nation-wide service when buying or selling equipment.
H. BLANE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Ill.

BOILERS
SEC. HEADER, STRAIGHT TUBES

1—432 HP, 225#, $25.00 per HP. Built 1943
3—461 HP, 225#, $10.00 per HP. Built 1923.
ALL IN GOOD CONDITION.

S. M. DAVIS
510 LASALLE ST., ST. LOUIS 4, MO.

---

500 HP Sectional Hdr. Boiler—1943
150 & 60 HP Erie Economic Boilers
250 HP (2) Kewanee Boilers—retubed
7500# 4'x8½' Electric Frt. Elevator
250 HP 1200 RPM Ideal Ind. Motor
1500 & 1250 HP BRAND NEW Syn. Motors
1000 NEW & 675 KW A. C. Generators

H. & P., 6719 Etzel, St. Louis 14, Mo.

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

MOTORS • GENERATORS • TRANSFORMERS

7x7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ER1—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 363 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 3/60/220/440/1800 X-Proof.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.

CL. 4758

BOILERS

10 to 1000 H.P

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.

507 FIFTH AVE., NEW YORK CITY

MURRAY HILL 7-6547-8-9

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

2—1000 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4000 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 250# Extr.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 280# N.C.
2—1000 KW, 480 V., 180# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 500 KW, 2300 V., 165# Cond.
1— 300 KW, 2300 V., 150# Cond.

DIESEL GENERATORS

1—1000 KVA, 2400 V.
1— 700 KW, 480 V.
3— 540 KW, 480 V.
1— 437 KW, 480 V.
1— 200 KW, 480 V.

FIRE PUMP

1—New 1000 G.P. Turbine Driven

BOILERS

1—1,000 HP, 250#
2— 500 HP, 220#
1— 438 HP, 200#
2— 300 HP, 250#
2— 250 HP, 200#
4— 150 HP, 150# Sa. Mr.
1— 78" H.R.T., 200#

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

TRANSFORMERS—60 cycle

2—1250 KVA, A. Ch., 4800/460—3 ϕ
2—1250 KVA, A. Ch., 4160/460—3 ϕ
1—2500 KVA, A. Ch., 4800/460—3 ϕ
1—2500 KVA, A. Ch., 4160/460—3 ϕ
1— 667 KVA, A. Ch., 4160/460—3 ϕ
3—1250 KVA, G. E., 13200/440—1 ϕ
3—1250 KVA, G. E., 13800/440—1 ϕ
3—1250 KVA, G. E., 7200/12470Y/440 1 ϕ
2— 750 KVA, Gen. E., 11000/480; 3 ϕ, 25 cycle
1— 500 KVA, Scott Bank 2200, 3ϕ—pri. 220/440 2 ϕ
1— 100 KVA, Wagner, 480/120/240—1 ϕ
1— 325 KVA, Furn. 2300/4600/125—1 ϕ
1— 100 KVA, A. Ch., Furn. 440/110/80/60—1 ϕ
3— 75 KVA, A. Ch., 33000/2300/4160—1 ϕ WH. SW. GR.
2—75 KVA Gen. Elec. type H, OISC, 4160/4600, 230/460, 1 Phase
3—50 KVA Kuhlman OISC, 11,000 V. Pri., 120/240/480 V. Sec. 1 Ph
6—25 KVA, Kuhlman OISC, 2300/4600 Pri., 115/230 Sec. 1 Ph.

M.G. SETS

1000 KW, A. Ch. 250 V. DC, 1400 HP, 3 ϕ, 25 cycle. Or will consider changing motor for 60 cycle. Complete with switchgear.
200 KW, A. Ch., 125 v. D.C.; Mtr. 300 HP 3/30
40 KW—1000 amp., 40 V—DC mtr, 7 SHP 3/60
60 KW—1500 amp., 40 V—DC, mtr. 100 HP 3/60
100 KW, 125 volt D.C. mtr. 150 HP, 3/60
30 KW, 125 V D.C. mtr. 50 HP 3/60

FREQUENCY CHANGERS:

KVA—465 25/60 cy. or 60/25—3 ϕ RPM 300 Motor 650 HP, 3 ϕ, 300 RPM with sw. gear
1—200 KVA Gen. Elec. 25 cyle to 62½ cycle, 750 RPM, Motor 300 HP, 25 cycle, complete with panels
1—120 KW, 25/62½ cycle, 3 ϕ 720 RPM. Motor 200 HP 3/25/720 RPM
3— 20 KVA, G.E., 60/180 cycles 3 ϕ
3— 30 KVA, G.E., 60/180 cycle 3 ϕ
3— 25 KVA, G.E., 60/120 cycle 3 ϕ
1— 15 KVA, G.E., 60/120 cycle 3 ϕ

SQUIRREL CAGE MOTORS

3 phase, 60 cycle

HP	Make	Type	RPM	Volts
150	G.E.	IK14	1200	2300
100	A. Ch.	S.C.	690	440/550
100	G.E.	IK17	400	220/440/2300
150	G.E.	IK17	514	220/440/2300
75	G.E.	IM S R	600	220/440/2300
75	G.E.	IK	400	220/440/2300
75	West.	CW S R	1200	2300/440/220
50	A. Ch.	ANY SR	900	220/440
40	Star	BB S R	900	220/440
40	G.E.	IK	900	220/440
100	G.E.	IK	1800	220/440
200	G.E.	KT 25 cyc.	750	220/440
200	West.	CS 25 cyc.	750	220/440
150	C. Wh.	25 cycle	480	2300/440/220

1—G.E. 3 pole switchgear 3700 volt 400 amp.
1—400 amp. 3 pole 15000 volt breaker G.E. FK132A

VOLLAND ELECTRIC EQUIPMENT CO., INC.

Subsidiary Co.—Buffalo Transformer Co.

1500 NIAGARA ST. **BUFFALO 13, NEW YORK**

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873C	2200	1160
1	200	Al.Ch.	AR	440/220	580
2	125	Al.Ch.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-663C	440/220	1750
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Whse.	CS-958	2200	495
1	78	G.E.	I-K15	440/220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	3000	Whse.	80	4800/2400	720
1	750	G.E.	80	2300	150
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	135	G.E.	80	4000/2200	1200
1	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600
1	60	G.E.	80	220/440	1200
2	50	G.E.	80	2200	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	1200	C.W.	SR	2200	237
2**	1000	Al.Ch.	ANY	2200	235
1**	600	G.E.	MT-20	2200	360
2	500	G.E.	I-16-M	2300	450
1**	400	Al.Ch	ANY	2200	514
2	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	Al.Ch.	ANY	2200	514
1	250	G.E.	MT-414	2200	900
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2200	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	IM	440/220	695
1	75	Whse.	CW-7540	440/220	690
1	60	Whse.	CW	440/220	900
1	50	G.E.	MT-536	2200	1150
1	50	F.M.	SR	440/220	600
1	40	Al.Ch.	ANY	2200/440	435

** Mill type pedestal bearing *** 3-Bearing

In our stock you will find manual and magnetic primary and secondary controls 10 to 3000 lbs., which we can furnish complete for any requirements.

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch.	720	525	4800/2400
1	2400(3-U)	Whse.	720	600	4800/2400
1	1000	G.E.	514	500	2300
2	600	C.W.	720	575	2300/440
1	500	C.W.	720	250/275	2300/440
1	250	Whse.	1200	125/250	2300
1	200	Whse.	1200	125/250	2300/440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	300	2300/440
1	100	Al.Ch.	1200	125/250	4000/2300
1	100	Detro	1200	125/250	440/220
1	100	C.W.	1200	125	440/220
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	4000/2300
1	75	Star	1200	250	440/220
1	75	Whse.	900	75	2200 *
1	75	Al.Ch.	900	250	2300
1	50	Burke	1750	250	440/220
1	35	Whse.	1750	250	440/220
1	25	Ideal	1750	125	220
3	20	Al.Ch.	1200	250	440/220
1	15	Al.Ch.	1200	250	440/220
1	9	Whse.	1200	125	440/220
1	5	Reliance	1750	250	440/220

TRANSFORMERS — Power

Qu	Make	KVA	Type	Phase	Voltage
1	G.E.	2760	DH	3	7300/6900-240/480
3	Whse	500	S	1	13800/72420/6900-4160/2400
4	G.E.	333	H	1	13200/1100-2200
3	Packard	250	A	1	13200-2200
3	G.E.	130	H	1	19000/9500-550/2200
3	G.E.	100	H	1	33000-2300
3	Whse.	100	88	1	12075/10955-230/460
3	Whse.	100	Auto	1	4160-2400-2400/1385
2	Wagner	50	HE	1	13200/11880-575-287
3	Al.Ch.	50	OISC	1	22000-220
2	Uptegraff	37½	HD	1	2300-115/230
2	Kuhlman	13	Dry	1	480-240
45(new)	Al.Ch.	3	OISC	1	2400-120/240

DIRECT CURRENT MOTORS

Qu.	HP	Make	Type	RPM
1***	3000	Whse.	Enel.(Rev.)	600
1***	2400	Whse.	Enel.(Rev.)	600
4***	1500	Whse.	Enel.(Rev.)	600
4***	1200	Whse.	Enel.(Rev.)	600
4***	800	Whse.	Enel.(Rev.)	600
1	350	G.E.	CD-169-A	1150
1	200/250	El.Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	MIII	300/1200
1	180	G.E.	MPC	400
1*	150	C.W.	83-H	890
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	100/125	Rel.	1995-F	300/1200
2	100	Rel.	1050-T	400/1200
1	90/160	G.E.	MPC	625/1125

All above 230-VDC except where marked ***
*** Pedestal bearing mill design 525/600-VDC.
Rev. designed for mill reversing service.
* T.E.F.C.

We have in stock 100 magnetic panels which we can furnish arranged for your particular requirements.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

IMMEDIATE DELIVERY

1—50,000# hr. 4-Drum Stirling type, 250# Boiler (8,500 sq. ft. H.S.) Superheat. Condition excellent, ASME, any fuel, now oil fired.

1—80,000# hr. Steam Generator 350#, Very efficient, economizer, air heater, etc. Steel cased, excellent condition.

768 HP B&W Sterling Boiler, 200#, with new tubes & superheaters.

● We have many other boilers in sizes of 250 to 600 HP, 200 to 480# pressure. See our September Power ad.

TRANSFORMERS! Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed.

Turbo-Generators, Condensing, 300 to 10,000 KW. Non-Condensing, 200 to 2500 KW. Frequency Changers Motor-Generators & Diesel-Generators See Our September Power Ad

Send us your INQUIRIES *for* ALL POWER MACHINERY

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

BOILERS ENGINES STACKS

2 ea. 25,000#/hr ASME 262# WP, 3604 HS Hedges-Walsh-Weidner Steel Sectional Header with steel shell and integral furnaces. Perf. cond. Good for OIL/GAS firing.

2 ea. 30,000#/hr ASME 200# WP, 4080 HS Steel Box header, set in tandem, with all boiler room equipment, 4" tubes. Ideal for coal, woodwaste, bargasse firing.

CORLISS TYPE STEAM ENGINES 18x36, 20 x 42. Dismantled and ready to ship. Perfect.

2 ea. 54" x 125' stacks. Like new.

UNITED STEEL PRODUCTS CO.

1534 Texas St. — MEMPHIS, TENN.

Phone 35-2855

TRANSFORMERS

3—1250 KVA., Gen. Elec., Type WC, Form VDD, Out-door, 1 ph., 60 cy., 23000/22425/21850 volts primary to 2300/2243/2185-4000Y volts secy.

TURBO GENERATING UNIT

1—100 K.W., G.E. Non-condensing, 3600 RPM. #27,160, 3 ph., 60 cy. 600 volts. (Can be reconnected 480 volts full capacity. Can be reconnect to 240 volts at rating 100 KVA.) Dir. Ctd. exciter.

ARCHER & BALDWIN, INC.

75 West Street — New York 6, N. Y.

Tel: BO. 9-9275-9276

DIESEL GENERATOR

25 KW, 230 V, 3 Phase, 3 W, 60 cy. generator. Direct coupled to Hill diesel model 6 R rated 44 HP at 1,200 RPM. This standard generating unit, complete with panel board is practically new and will be sold under guarantee.

Write Box 159

OAKHURST, N. J.

ELECTRIC AIR COMPRESSORS

676 FT. WORTHINGTON, 2 STAGE
1302 FT. INGERSOLL-RAND PRE-2
2415 FT. INGERSOLL-RAND PRE-2
2690 FT. SULLIVAN WN-4
2675 FT. WORTHINGTON, 2 STAGE
3460 FT. CHGO. PNEU. OCTDE

STANHOPE, 60 E. 42 St., N. Y., N. Y.

100 KW GENERATOR SET

BUCKEYE DIESEL 400 RPM 3/60/240 with V-Belted exciter, Switchgear, Voltage Regulator, Oil filter, Silencer, Water Pump. Engine overhauled.

Immediate delivery—Priced to Sell

ROBERT L. HEISWANDER

LIMA, OHIO PHONE 42867

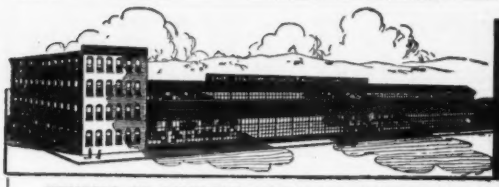
GOVERNORS

WOODWARD & MARQUETTE

Various Models in Stock

ALJON ELECTRIC DIESEL CO.

904 Pacific St., Brooklyn — STerling 3-6515



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDING ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	900	440	G.E.
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
60	1200	440	Westgh. CS
50	1800	220	Triumph
50	720	2200	Westinghouse
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220	L-A-HD
25	1200	220	Century
25	900	440	G.E.
25	720	220	Westinghouse
25	600	440	G.E.
23	3600	440	A-C
20	1800	220/440	G.E.
20*	1800	220/440	Wesche
20	1200	440	A-C
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell
15	720	220/440	A-C
10	3600	220	R. & M.
10	1800	220	Westinghouse
10	1200	220	A-C
10	900	220	A-C
10	720	440	A-C

* New Motors

SPECIAL

NEW DIESEL

Murphy ME650—165 HP, 1200 RPM 6 cylinder, 5¾ bore, 6½ stroke, complete. Will furnish engine only or as AC or DC Engine-Generator Set.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
300	1200	440	Westgh.-CW
300	720	2200	Al. Ch.
250	600	2200	G.E.-I17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
150	1800	440	G.E.-MT
150	720	2200	Al. Ch.
125	900	550	Ideal
100	720	440	Al. Ch.
100	400	440	West. Elec. (GE)
75	600	440	Al. Ch.
75	300	550	G.E.
60	1800	220/440	Al. Ch.
60	900	2300	Burke
50	1200	220	F-M
50	900	2300	Ridgeway
50	720	440	Al. Ch.
45	1200	440	Westgh.
40	900	220	Al. Ch.

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
750	500	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
400	250	Westgh.-G.E.	680	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	750	440
200	250	G.E.-Westgh.	300	1200	440
100	250	Westgh.	147	1200	4000
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	80	1200	220/440
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440
12½	230	Westgh.	19½	1800	220
10	250	Westgh.	15	1800	220/440
7½	125	Westgh.	10	1200	220
5	230	Westgh.	7½	1200	440
3	250	Reliance-G.E.	5	1800	220
1	115	G.E.	1½	1800	220/440

TOTALLY ENCLOSED, FAN COOLED BALL BEARING, SQUIRREL CAGE MOTORS

HP	RPM	VOLTS	DESCRIPTION
50	1800	220/440	Reliance-B1052
30	900	440	Reliance-260AA
25	1200	220/440	Reliance-C405
7½*	1800	220/440	Master-284
7½	1800	220/440	G.E.-KT312
7½	1200	220/440	G.E.-KF324
7½	1000	220/440	G.E.-KF324
7½	900	220/440	Delco-326
5*	3600	220/440	G.E.-KT25
5	3600	220/440	Delco-225
3½	1620	220/440	L-A-224 Hi Slip
3	3600	440	Westgh.-W284
3	1800	220/440	Delco-225
3	1800	220	G.E.-KT3948
3	1200	220/440	Westgh. CS254

* New Motor

IGNITRON

OUTDOOR
WEATHERPROOF
New 1948

300 K.W., 13800/600 V.D.C.

TRANSFORMERS

1—G.E. 1050 K.V.A.
60 cyc. 13200/445 OISC

1—WHSE 500 K.V.A.
60 cyc. 33000/445 OISC

3—WHSE 100 K.V.A.
25 cyc. 13200/432 OISC

JOHN D. McGUIGAN, INC.
616 S. MICHIGAN AVE.
CHICAGO, ILLINOIS

M.G. SETS & CONVERTERS

KW	MAKE	RPM	D.C.	A.C.
750	Al. Ch.	720	250	2300
500	West. Rotary	1200	250	2300
400	West.	720	550	2300
300	GE	1200	250	2300
300	GE Rotary	600	250	2300
300	West.	1200	250	2300
300 (2)	Al. Ch. Rotary	1200	250	2300
300	West.	1200	550	2300
150	GE	900	550	2300
150	West.	1200	250	2300
50	G.E.	1200	250	2300

PLATING M-G SETS

3—1500/3000 Amp. 6/12 Volts—AC Syn Motors
1—1500/3000 Amp. 6/12 Volts—AC Sq.C. Motor
1—1000 Amp. 75 volt 75 KW—AC Sq.C. Motor

MANY OTHER SIZES IN STOCK

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	GE	450	Sl.Rg.
300	GE	450	Sl.Rg.
150	GE	600	Syn.
100	West.	900	Syn.
100	West.	1200	Sq.Cg.
100 (2)	GE	1750	Sq.Cg.
100 (2)	GE	450	Sl.Rg.
75	West.	900	Sq.Cg.
60	West.	600	Sl.Rg.
50	GE	1750	Sq.Cg.
40	GE	900	Sl.Rg.
40	West.	900	Sq.Cg.
30	G.E.	900	Sq.Cg.
30	G.E.	1200	Sq.Cg.

AIR COMPRESSORS

356 CFM Chg. Ph. 12"x10" NSB 100#.
142 CFM Ingersoll Rand 25-B. Late type. Portable.

MOORHEAD ELECTRICAL MACHINERY COMPANY
361 Noblestown Road (Est. 1919) **Oakdale, Penna.** Pittsburgh District

---

SPECIAL OFFERING OF 250 HP PACKAGE STEAM GENERATOR

1—NEW & UNUSED AMESTEAM GENERATOR, size A-250, 250 HP, normal rating at 150# steam working pressure, for #5 oil or natural gas firing. Complete with all accessories. Full particulars furnished upon request. Available for immediate delivery.

BOILER SPECIALS

1—Babcock & Wilcox cross drum, forged steel header, straight tube water tube boiler, built 1936, ASME and NATIONAL BOARD Normal rating 263 HP at 225# pressure.
2—Babcock & Wilcox forged steel header, straight tube, vertical headers, rated 400 HP each at 200# pressure, oil burners are included.
1—Erie City, 3 drum, bent tube water tube, built 1940, rated 500 HP at 250# pressure, complete with oil burners, can produce 29000# steam per hour and if water walls were installed could produce 42000# steam per hour.
1—Combustion Engineering, 3 drum, low head, bent tube water tube, built 1943, rated 400 HP at 185# pressure. Used very little.

We also handle package boilers and other boilers, all sizes and pressures.
We have power distribution transformers, switches and other gear; also Turbines, Generators etc.

HOWE BROTHERS
342 MADISON AVENUE **MUrray Hill 2-8562** **NEW YORK 17, N. Y.**

Poor Aladdin . . .

The best service at Aladdin's command was rubbing a lamp and WISHING for what he wanted. YOU have "Searchlight" to help you find what you want!

Can "Searchlight" Serve You?

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2200	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
250	440	G.E.	600
200	440	G.E.	450
188	1000/2300	G.E.	1800
150	440/220	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
140	1000/2300	G.E.	1200
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2300/400	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Sync.	600
240	2300/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GK	600

PLATING UNIT

1—5,000 amp., 4-6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator, dir. conn. to 50 hp. G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air
1—400 amp., 32000 V., G.E., Type FHKO-236 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	110	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
280	2200	G.E.	FT	3600
250	110	G.E.	IK	720
250	2200	Al. Chal	AR	1800
200	2200	G.E.	K	200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
150	440	multi sp.	KT	1800/600
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva. 600 rpm. 2300/440/220 V., G.E.
1—275 kva. 1200 rpm. 440 V., G.E.
1—250 kva. 720 rpm. 2300/440 v., G.E.
1—225 kva. 600 rpm. 220/440 v., G.E.
1—187 kva. 1200 rpm. 440 V., Whse.
1—150 kva. 900 rpm. 480/240 v., G.E.
1—100 kva. 720 rpm. 440 V., G.E.
3— 75 kva. 1800 rpm. 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230 (2)	Whse.	SK	850
125	230	Whse.	SK	850/1050
100	230	El. Dyn.	20-3	475/1150
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 230 V., Whse., conn. to 375 HP, 1200 rpm, 2200 V., syn.
1—175 kw, 1200 rpm, 230 V., G.E., conn. to 230 hva, 1200 rpm, 2200/440 V., syn.
1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage.

TRANSFORMERS 60 CY.

3—333 kva, G.E., 13,200—2300 V.
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3—250 kva, G.E., 2400-480 volts.
3—250 kva, Whse., 11,000/22 000—2300 V.
3—200 kva, Whse., 2400—240/120 V.
1—150 kva, Whse., RK, 13200-125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—150 kva, Whse., 2400-240/480 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
5—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
6— 50 kva, G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

GENERATOR SETS

100 KW 200 KW

General Motors 3 Cylinder Diesel Engine Sets Model 3-268A, Direct Conn. to: 100 KW Westinghouse Alternators 3/60/440 Volts. Inc. Switchboards.

ALSO — COMPLETELY REBUILT

General Motors 8 Cyl. Diesel engine, Model 8-268A, Direct conn. to: 200 KW General Electric Alternator 3 Ph., 60 Cy., 440 Volts. Inc. Switchboard.

OTHER SIZES IN STOCK FROM 15 to 1000 KW

Ready for immediate shipment

ALJON ELECTRIC DIESEL CO.
904 Pacific St. Brooklyn 16, N. Y.
STerling 3-6515

DIESEL and GASOLINE

ENGINES and GENERATOR SETS

1 to 2000 K.W.

Transformers, Electrical Equipment
Sales, Purchases & Rentals
Nordberg Distributors

MIDWEST UTILITIES
POWER EQUIPMENT CORP.
1270 Augusta Blvd., Chicago, Illinois
EVerglade 4-4511

FOR SALE

2 only Canadian Westinghouse 1000 KW Motor Generator Sets, each composed of:
1—1475 HP 3/60/2200, 600 RPM Motor
2—500 KW 50/125 volt, D.C. 4000 amp. Generators
1—25 KW, 125 volt D.C. Exciter

3 only Canadian General Electric 1000 KW Motor Generator Sets, each composed of:
1—1150 KVA Synchronous Motor, 3/60/2200, 514 RPM, Class 14-1150-514
2—500 KW 75/125 volt DC, 4000 amp. Type MPC Class 10-500-514 Generators
1—11 KW, Shunt Wound, 125 volt D.C. Exciter

Starting equipment, AC Panels and DC Panels included with each set. Four sets will be available May, 1952 and fifth set shortly after. Reply to:

THE CONSOLIDATED MINING and SMELTING COMPANY of CANADA Limited
Trail, B.C. Attention: Purchasing Agent.

AIR COMPRESSORS FOR SALE

1—Chicago Pneumatic Tool Company Air Compressor
1,200 cu. ft. free air per min. at 125 psi., Engine Type—Skinner double seat poppet valve for 160 lb. steam pressure operating condensing or 5 lb. back pressure, complete with barometric condenser and auxiliaries. While installed in 1923 this unit has had less than 17,000 operating hours. Estimated weight—31,000 lb.

1—Murray Iron Works Air Compressor
1,500 cu. ft. free air per min. at 125 psi., Engine Type—Cross Compound Corliss for 160 lb. steam pressure operating condensing, complete with surface condenser and auxiliaries. Unit is capable of operating on 5 lb. back pressure if air discharge pressure is reduced to 100 psi.
Estimated weight—110,000 lb.

These units were used for pumping water by air lift. This method has been superseded by deep well turbine pumps. Both units in operating condition and are available for immediate dismantling. May be inspected at the Cedar Street Pumping Station.

BOARD OF WATER AND
ELECTRIC LIGHT COMMISSIONERS,
LANSING, MICHIGAN

ELECTRICAL CABLE

- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

EXCELLENT POWER UNITS

2—125 KVA Westinghouse AC generators, 440 Volts, 277 RPM. Powered by 2 Bruce Mac Beth gas/gasoline engines.
1—150-HP, 225 RPM, Synchronous motor. Real Bargains.

A A A IRON CO.
Canton & Hawkins Sts., Dallas 1, Texas

EQUIPMENT FOR SALE

200 H.P. B. & W. 160# Boiler, 1931.
225 H.P. B. & W. 160# Waterwall, Boiler 1949.
(2) Penn. Air Comp. 252 CFM 40 lb. 25 H.P.
(5) 14"x20' Frick Dehydrators Complete.
(2) 30"x16' Amm. Condensers (1) Receiver.
(1440) 300# Galv Ice Cans, Air tubes.
(2) Slat Conveyors (25 ft) (75 ft).
(4) 4696 sq ft Frick Vertiflow Coil units.
(4) 3 H.P. Vert. Brine Agitators.
160 Ton Vilter Elec. Amm. Comp. 250 H.P.
80 Ton H. & C. Amm. Comp. Steam driven.
Amm. Accumulators, Misc Valves & Fittings.
25 H.P. Sellers Auto. Gas Jet fired boiler complete.
1500 G.P.H. Coch. IJS H.P. water Softener.

ALL IN FIRST CLASS CONDITION.

POWER ENGINEER
915½ W. LaSalle Avenue
South Bend, Indiana

FOR SALE

Used Equipment—Good Condition

Inspection Invited

EVAPORATING & CRYSTALLIZING PLANT—7 Swenson Calandria type Evaporators and one Vacuum Crystallizer, two stage. Complete plant with pumps, etc., on steel structure.

POWER PLANT—3—500 HP B & W Sterling type Boilers, complete aux. equip. Also 2 Waste Heat Boilers, same type. 1250 KVA 440 V. Generator direct connected G.E. Steam Turbine, switch board and aux. equip. Also steam driven C.P. Air Compressor size 12" x 14" x 11".

Write for Particulars

MANGANESE, INC.
P.O. Box 2008 HENDERSON, NEV.

"BERGERIZED"

MOTOR GENERATOR SETS

500 KW West. Motor Gen. Set—2 Unit 3 Bearing—Consisting of the following: Gen.—500 KW, Compd. Wound—250/125 V—3 Wire—2000 Amps—1200 RPM, connected to a 719 HP, .8% P.F.—Synchronous Motor, 2300 Volts, 3 Phase, 60 cycle, 1200 RPM, Fields 250 Volts Excitation—Complete with AC and DC Control.

250 KW G. E. Motor Gen. Set—Type MPC—1200 RPM—250 Volts DC—Compd. Wound—Interpole—SB—Driven by a 375 HP G. E. Motor—SB—1200 RPM—3p-60c-2300 Volts.

125 KW G. E. Motor Gen. Set—Type MPC—1200 RPM—250 Volts DC—Compd. Wound—Interpole—3 Bearing—2 Units—Driven by a 200 HP G. E. Synchronous Motor—Frame 7558—Type TS—1200 RPM—3 Phase—60 Cycle—220/440 V.—Complete with Control.

20 KW G. E. Motor Gen. Set—Frame 83—BBSP—250 Volts DC—Type CDM—1800 RPM—with 30 HP—G. E.—Frame 365—Type KF—1800 RPM—3-60-220/440 V.

All of this equipment is in our own stock for quick shipment at attractive prices.

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FREQUENCY GENERATORS

125 KW Electric Machinery—Frequency Gen.—80% P. F.—1200 RPM—3 Phase—180 Cycle—240 Volts.

100 KVA West. Frequency Motor Gen. Set—3 Phase—1200 RPM—60/180 Cycle—220 Volts with a 125 HP West. Synchronous Motor Drive—1200 RPM—3 Phase—60 Cycle—440 V.

30 KW West. Frequency Motor Gen. Set Type CW—1800 RPM—60/120 Cycle—3 Phase 220 Volts with a 25 HP Drive. Type CS—SSB Squirrel Cage—Frame 473C—1800 RPM—3 Phase—60 Cycle 440 Volts.

25 KW G.E. Frequency Motor Gen. Set Type ITT—900 RPM—60/180 Cycle—3 Phase—220 Volts driven by: a 25 HP G.E.—Type KT—900 RPM—SB Squirrel Cage—3 Phase—60 Cycle—220/440 Volts.

•Bergerized motors have a factory guarantee of one year look and will perform like brand new.

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COMPLETE DIRECT DRIVE DIESEL POWER PLANT, with 50 KVA electric generator belted to drive shaft.

DIESEL EQUIPMENT: one 112½ HP engine and complete supplementary equipment, including a 12,000 gal. fuel oil storage tank, to make a complete operating installation.

GENERATING EQUIPMENT: one 50 KVA generator, one dc generator, switchboard panel and instruments and voltage regulator.

PRICE: All, loaded on cars, fob Greensburg, $5,500.00.

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GREENSBURG INDIANA

Attention CHAS. F. SCHEIDLER

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qu.	HP	Mfg.	Volts	Type	Fr.	RPM
2	60	Louis Al.	220/440	TEFC	505	1180
1	60	Woods	220/440	TEFC	72	1200
1	100	West.	440	CS		600
1	100	G.E.	440	KT	358	860
10	100	Weste.	2200	CS	774C	865
1	125	G.E.	440	KT	547	1800
2	*150	Al.-Chal.	2300	ARW		1750
1	200	**G.E.	220	K	564	900

SLIP RING MOTORS—3 Ph., 60 Cy.

1	30	G.E.	220	MT	342	600
1	40	G.E.	220	MT	346	600
1	40	**Al.-Chal.	440	B. Brg.		900
1	50	West.	220	CW		1175
1	75	G.E.	220	MT	456	870
1	100	G.E.	220		16	430
1	*250	C.W.	550	BW	68-CS	1800
1	*300	C.W.	550	BW	68-DB	1800
1	*500	C.W.	550	BW	80-BS	1800
1	500	G.E.	2300		17B	900
1	*600	C.W.	550	BW	80-CS	1800
1	600	West.	440	CW	432D15	1800

SYNCHRONOUS MOTORS—3 Ph., 60 Cy.
With Direct Connected Exciters

1	75	El. Mach.	220			1200
2	125	**El. Mach.	4800			900
15	135	***G.E.	4800	TS	963Z	1200
1	175	Burke	2200	F	40	720
1	*200	**El. Mach.	208			1200
1	*300	**El. Mach.	208			1200
1	*350	**El. Mach.	208			1200
1	*400	**El. Mach.	440			1200

DC MOTORS BALL BRG. MARINE TYPE

Qu.	HP	Mfg.	Volts	Type	Fr.	RPM
4	*20	**Al. Chal.	115	EBC	90	2400
1	*12	**Rel.	115	Y	40T	1300
2 Vert.	30	**Cent.	230	DN	375Y	1750
2	*50	**Cent.	230	DM	454S	2200
2 Winch	42.5	**G.E.	230	CDM	1830AE	525
3 Winch	50	**West.	230	CK	9	600
8	75	**C.W.	230	TEFC	52M	860
1	75	**Al.-Chal.	230	DEB-1		1150

DC GENERATORS BALL BRG. D.P.

11	25 KW	West.	125	SK	103	1800
7	25 KW	El. Prod.	125			1800
1	30 KW	Burke 1-Brg.	120	WA2	52	1450
2	300 KW	G.E. 1-Brg.	345/260	CY	221	1200

AC GENERATORS 3/60/440/.8 P.F./1800

11	75 KVA	***West	1-Brg.	
7	75 KVA	**El. Prod.	1-Brg.	
1	62.5 KVA	El. M.	2-Brg.	120—208V/900 RPM
1	125 KVA	G.E.	2 Brg.	50-60/120-208-400V

DIESEL ENGINES—PUMPS
TURBINE GENERATORS—M-G SETS

4 New Hercules 135 HP Mod. DWXD
250 KVA Elliott Turbe Gen. 3/60/208V/1200 RPM
150 KW G.E. 3 Brg. Syn. 3/60/220V/1200/240 V/DC
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1—200 KW Buckeye AC 3/60/2200V/300 RPM
Worthington Fire Pump—1000 GPM w/100 HP G.E. KT 543 3/60/220V/1800 w/compensator
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Rating 125 H.P. 17,500 sq. ft. EDR, 4,200,000 BTU per HR, 150 psi equipped for oil fire, with petro W-7 burner directly driven by 208 volts, 2 Hp 3 phase, 60 cycle induction motor.

Appurtenances included safety valves, blowdown valves, water column gage glass and cocks, electronic combustion control, water level controller with low water cut off, switch and starter for burner motor, non return valve, oil pump and pre-heater.

Last inspection was in 1946 at which time it was appraised at $10,000.00. Will sacrifice.

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DIESEL ELECTRIC GENERATING SET

Powered by Buda Diesel 8 cyl. engine, Model 8DC1125. 340 H.P. Maximum.

Generator—Mfgd. by Electric Machinery Co., 3 phase, 220-440V, 75KW, 94 KVA. Generator V Belt Driven.

Used very little. A-1 Condition. $5500.00. *Phone or write*

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1—#3 Relay 1949 Atrita Unit Pulverizer, with 60 H.P., 1800 RPM, 220/440 V. 60 cycle, totally enclosed motor, Rawson Coupling, also Riley Table Type Feeder with Reeves Variable Speed Drive. Has had very little use.

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Most all units still on foundation. Many may be seen operating

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1000 KVA Elliott-DeLaverne
1000 KVA (2) GE-Nordberg
438 KVA (2) GE-Winton (Gen. Motors)
375 KVA (2) GE-DeLavergne VO
375 KVA Fairbanks-Morse 32E14
353 KVA (2) Fairbanks-Morse 32D
312 KVA (2) Wghse.-Worthington
250 KVA Fairbanks-Morse 32E14
250 KVA GE-Buckeye, E-8
250 KVA Ideal-Buckeye, "80"
187 KVA GE-Buckeye "80"
175 KVA Fairbanks-Morse 32E14
125 KVA Ideal-Buckeye "E"
94 KVA Elec. Mchy.-Buda-8
90 KVA Fairbanks-Morse 32E14
75 KVA (2) General Motors (package)
62 KVA International Harves. (package)
50 KVA (2) Fairbanks-Morse 42F

350 HP Buckeye "80"
300 HP Buckeye "8"
240 Buda "HDC-8"
225 HP Buckeye (belted)
180 HP Fairbanks-Morse (belted)
151 Buckeye "80"
128 HP (4) Caterpillar (belted)
120 HP Fairbanks-Morse 32E

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1000 KVA (2) GE-Nordberg
750 KVA Elec. Machy.—800 HP Worthington

BOILERS

309 HP Combustion 3 dr. 160#
285 HP B&W 3 dr. 250#
255 HP (2) Combustion 200#
Three 250 HP HRT 150#

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1250 KVA GE 3/60/480 v; bleeder
1000 KW GE-250 v. DC (Bleeder)
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300 KW Elliot, 250 v. DC—non-cond.
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SURFACE CONDENSOR 4000 Sq. Ft. Wghse.

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187 KVA Wghse.-Ames vertical

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2500 HP SLIP RING MOTOR
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GENERATOR—shunt wound—two wire—135 to 150 volt—3000 to 4000 amps.

MOTOR—3 phase—25 cycle—440 or 4160 volts—excitation from DC generator.

Both AC and DC control equipment required

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Steam Turbine, Geared, Variable Speed, 200 H.P. 150# Throttle Steam Pressure, 50# Exhaust Pressure, 100 to 600 R.P.M. at low speed gear. Oil Relay Governor with not more than 6% speed regulation. Water rate not to exceed 55# per H.P. hour at above steam conditions.

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4—100 KVA or 6—50 KVA used or reconditioned Transformers, rated at 7200/12400 Y Primary and 240-480 Volts Secondary.

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1—80' Stack
1—10,000 gal. Tank
2—Permutit Water Conditioners
1—Make Up Tank & Pump

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1100 KW GENERAL ELECTRIC ALTERNATOR

3 phase, 60 cycles, 2300 volts, 300 RPM, direct connected Exciter, single bearing serial #523940, type ATI, 24-1388-300, Form A.

In excellent electrical & mechanical condition, like new. Immediate delivery.

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5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.

1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.

2—8000 HP Webster Water Heaters.

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6—Steel Coal Bunkers, 80 tons each.

1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)

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1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-stage Steam Turbine, 1800 RPM.

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1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.

1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1—1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.

1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.

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7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.

1—Kennecott Pressure Type Industrial Water Filter.

1—50-Ton Electric Traveling Crane—55'5½" Span.

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1—375 HP Worthington, 200 KW, GE Gen.
1—300 HP Worthington, 125 KW, GE Gen.
1— 45 HP GM Engine Gen. Set.
Switch Gear, Panel & Auxiliary Equip.

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COMPLETE 12,000 KW STEAM GENERATING PLANT

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200 Psig 100° Superheat
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2300 Volts 3600 RPM

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12000 GPM for 25' Head, 580 RPM.

Three Spray Type

DEAERATING HEATERS

64,000# per hour

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TRANSFORMERS

25 cy. 60 cy. D.C.

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1-1500 H.P.

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BOUGHT and SOLD

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ROCHESTER 1, N. Y.

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KVA	Make	Voltages—Pri. Volts	Sec. Volts
3750(1)	Uptegraff	22000	600
3000(1)	Uptegraff	22000	550
2500(3)	West.	27600	2300
2000(3)		45000	2300
1500	GE	2200	600
1500(5)	Pitts.	33000	2300
1250(3)	GE	11000	2200
1000(4)	Am.	33000	2300/4000Y
1000(3)	Penn.	13800	230/460
1000	West.	2200	220
833(2)	GE	13800	460
833(3)	West.	2300	575
750	GE	2300	2/3 ph. 2300
750(4)	GE	2200	244/488
667(6)	West.	11500	460
667(3)	GE	13200	2300/4000
667(1)	Al. Ch.	13200	480
667(3)	Davis	6600	2300/4000
500(1)	Mol.	13800	230/115
500(2)	GE	11000	2300
500		4600	460
500	GE	34500	230/460
480(11)	GE	22000	190
480(3)	West.	22000	190
450	Uptegraff	11000	460
450(1)	Uptegraff	11000	230
400(2)		2300	3 ph. 230
400(3)	Wag.	2300	440/220
400(3)	GE	2200	244/488
333(1)	GE	22000	2200
333(3)	GE	22000	2200
333(1)	GE	22000	2300
333(2)	GE	11500	115/230
333(3)	GE	11000	2200
300(3)	West.	14520	550/230
300(1)	Pitts.	6600	110
300(3)	Pitts.	2300	115/230
300(2)	GE	2300	115/230/440
250(1)	GE	2400	240/480
250(2)		2300	115/230
250(3)	GE	2400	240/480
250(1)	Wag.	2200	440
250	West.	460	
250(3)	Mol.	34500	2300
200(3)	West.	26400	267
200(3)	GE	15000	230
200(2)	West.	13800	278
200(3)	West.	13200	2300
200(1)	Pitts.	4150	460
200(2)	Pitts.	12000	115/230
200(3)	GE	2400	120/240
200(3)	GE	495	120/240
200(2)	GE	2200	122/244
200(3)	GE	11500	460
200	West.	3984	115/230
200(3)	GE	6900	2400
200(3)	Al. Ch.	3300	220/440
200(5)	GE	2300	440
200(5)	West.	23000	440
150(1)	West.	6900	120/208
150(3)	West.	14400	600
150(3)	West.	14400	575/2[illegible]
150(4)	GE	12000	115/2[illegible]
150(1)	West.	2400	4[illegible]
150(2)	Packard	4600	230/115
150	GE	2400	240/480
150(3)	Pitts.	7200	115/230
150(3)	GE	4160	120/240
150(3)	Al. Ch.	7620	240/480
150(3)	Pitts.	2300	240/440
125	West.	440	440
125	West.	440	440
100(4)	Penn.	600	120/240
100(3)	GE	14490	2400/4800
100(2)	Al. Ch.	4600	230/115
100(2)	West.	13200	220
100(4)	Al. Ch.	2400	480
100(2)	Pitts.	2300	230/460
100(1)	West.	2300	230/115
100(7)	GE	1980	220/440
100(3)	GE	1100	220/440
100(3)	Pitts.	4600	230/115
100(3)	GE	460	115/230
100	GE	11500	230/460
100	GE	11000	2300

MOTORS — MG SETS

— World's Largest Inventory —
We Stock 1200 Units 5 to 75 KVA

ELECTRIC EQUIPMENT COMPANY

ROCHESTER, N. Y.

PHONE: LD-65

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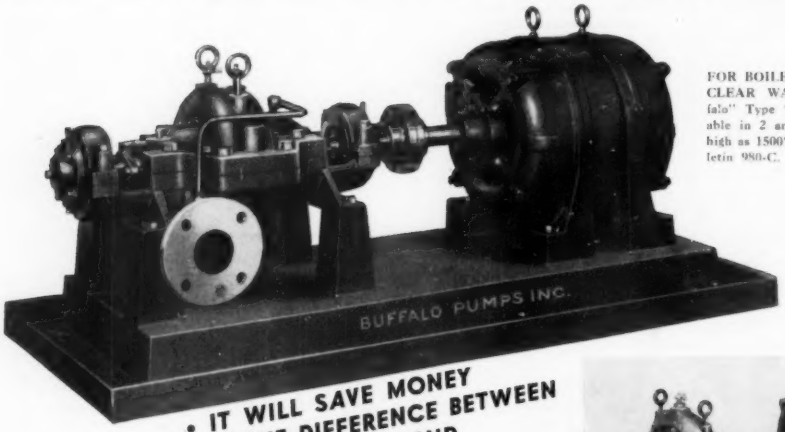
"Buffalo" *Tips on Better Pumping*

IT'S IMPORTANT TO CHOOSE THE RIGHT CAPACITY



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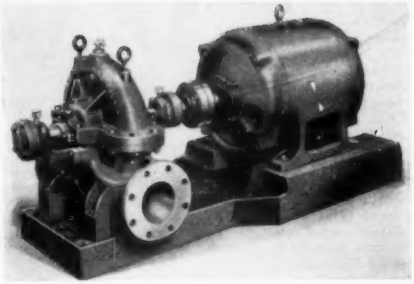
Contrary to popular belief, centrifugal pumps are not rated solely on gallons per minute, at so many pounds per square inch pressure. Rather, they move pounds per hour of liquid through a specified hydraulic gradient. Thus, specific gravity of the liquid, as well as discharge head in feet, and gallons per minute, must be specified.

Giving your pump supplier all possible information as to hydraulic conditions will result in the best selection of a pump for your job. "Buffalo" builds centrifugal pumps in the capacities you need and in the design you need to make your pump investment most satisfactory to you.



Above, "Buffalo" Double Suction Pumps are high quality clear water pumps often used in air conditioning service. In capacities up to 10,000 gpm. Write for Bulletin 955-N.

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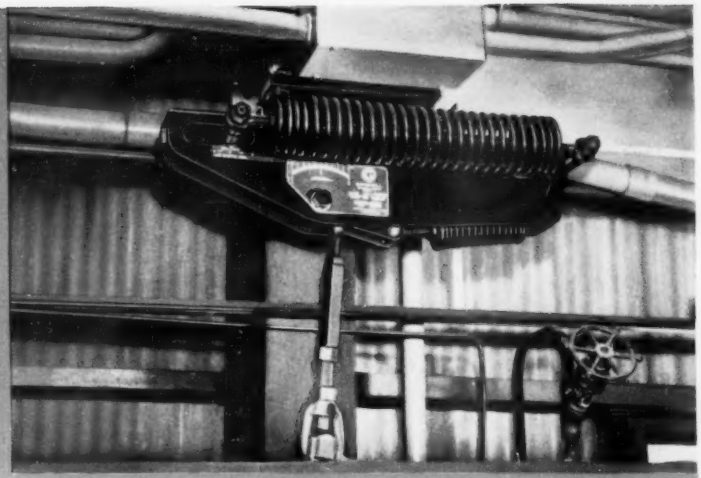


Grinnell Model L Constant-Support on 12-inch main steam at Somerset Power Station, Montaup Electric Co., Somerset, Mass. Pressure, 1300 psi; temperature, 930°F; load, approximately 4000 pounds. Note minimum headroom available.

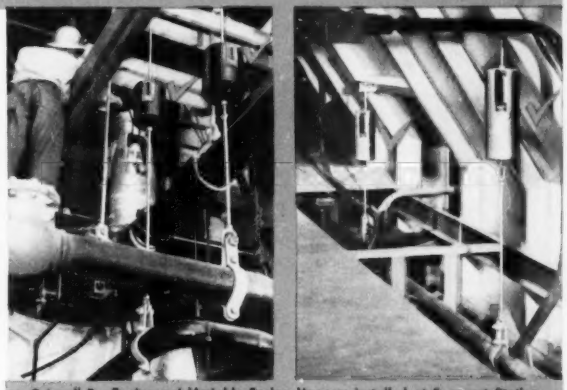
Thermal deflection of piping in today's high pressure, high temperature power stations necessitates flexible support of piping.

Where reactive forces at terminal points in a piping system must be kept within specified limits, constant-support type hangers are recommended. They are designed to provide substantially uniform supporting force equal to the pipe load throughout the travel range and should be used at superheater outlets, turbine connections, and also on high temperature and other critical lines.

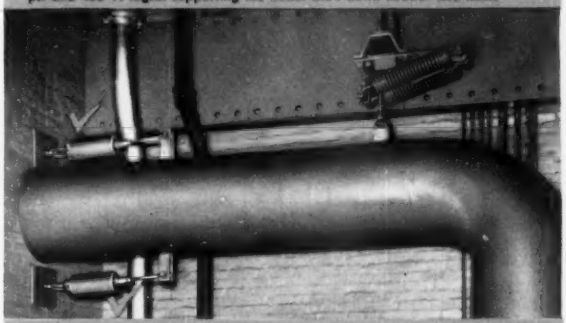
When pipe lines are subject to vertical movement and restrictive conditions do not require the use of a constant-support type, variable spring hangers are recommended. They should be designed to support not less than 85% or more than 120% of the designed load for the total travel.

When necessary to prevent abnormal movement or vibration in pipe lines, controls or sway braces of the energy-absorbing or instant-acting, counter force type are recommended.

Grinnell manufactures a complete line of engineered pipe hangers and supports; maintains a laboratory staff of trained technicians; provides highly skilled assistance and advice right from the design stage; and offers experienced field engineering service.



Grinnell Pre-Engineered Variable Spring Hangers installed at Somerset Station. Left: supporting boiler feed discharge lines, carrying steam at approximately 1785 psi and 455°F. Right: supporting the boiler blow-down header and lines.



Grinnell Vibration Controls on main steam line at Somerset Station.

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